TOWARDS A UNIVERSAL MODEL OF READING

INVESTIGATIONS INTO PERSIAN MONOLINGUAL AND ENGLISH – PERSIAN BILINGUAL SPEAKERS

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In the name of Allah, the Compassionate, the Merciful

In Memory of Mohammad Reza Sadeghi

A source of love and support

A friend

A father

The material presented in this thesis is the original work of the candidate except as acknowledged in the text, and has not been previously submitted, either in part or in whole, for a degree at this or any other University.

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~ Amir Sadeghi

Abstract

The research reported in this thesis aimed to investigate potential cognitive-linguistic predictors of reading comprehension levels amongst Persian monolingual and Persian-English bilingual primary school children. The Persian orthography, unlike English, is written from right to left. It is cursive and most of the letters change their shape when connecting to letters on one or both sides. The orthography also has the feature of using marks to represent sounds within the language. These marks are not always included in written text, particularly when the text is targeted at more experienced readers.

Over 200 school-children in Iran from grades 2 to 5 were given measures of text reading comprehension involving Cloze completion or passages followed by questions. Comprehension levels were compared to scores on measures of language competence, phonological ability, orthographic processing and speed of processing. Analyses indicated that Persian reading comprehension levels, consistent with English models of reading, were predicted by measures of linguistic competence and word decoding, with the latter being predicted by phonological and orthographic processing skills. However, orthographic skills and speed of processing showed predictions of Persian reading comprehension independent of word decoding processes, findings that differed to those predicted from the English-language derived models.

These findings were examined among over 150 Persian-English bilingual children in Persian grades 2 to 5 who attending mainstream schools in New Zealand or Australia. These children were being educated in an English medium context, but with Persian as their home language. Analyses of predictors of reading levels verified the findings reported from the monolingual data. In addition, comparisons of good and poor reading comprehenders argued for deficits in

either language or word decoding skills to potentially produce different sub-groups of poor readers, with the findings also being consistent with deficits in phonological decoding and/or orthographic processing skills consistent with dual-route or triangle models of literacy learning disabilities.

The thesis findings were used to derive a model of Persian reading comprehension similar to the simple view of reading. The findings can also inform the development of cross-language models of reading and global theories of reading comprehension.

Publications/Presentations Arising from the Thesis

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Chapter 1

General Introduction and Overview of the Thesis/Research

1.1 Introduction

Reading comprehension is a complex process and the ultimate goal of reading. To provide a better understanding of reading comprehension process, many theoretical models have been proposed; these include the more elaborated models, such as the construction-integration model (Kintsch, 1998) , to the relatively simple models, such as the simple view of reading (SVR) (Gough & Tunmer, 1986; Hoover & Gough, 1990; Tunmer & Chapman, 2012). The SVR suggests that reading comprehension is the product of linguistic comprehension and decoding. Thus, word recognition processes have also received much attention in the literature. Similar to reading comprehension, there are several models of word recognition, such as the dual-route model (Coltheart, 1985, 2006) and the triangle model (Plaut, McClelland, Seidenberg, & Patterson, 1996). (These models will be explained in Chapter 2 of this thesis to provide the theoretical framework/foundation for the studies reported.)

Reading is converting the graphic representation of the language into linguistic conceptual objects (words and morphemes) (Perfetti & Liu, 2005). Despite research indicating that reading processes depend on the language of the reader and the writing system that encodes that language (Perfetti, 2001), most of the reading models/interpretations on reading processes have been derived from studies of English speaking individuals. Although underlying cognitive skills that predict literacy learning skills have been found across a number of languages, there is still a need to investigate these skills in other orthographies, for

example by focusing on similarities in orthographic processing across writing systems (Frost, 2012) before confirming the current theories or reading models universally.

In fact, one of the reasons for caution here is that children learning a transparent orthography with a more consistent relationship between written symbols (letters/graphemes) and language sounds (phonemes) than that found in English seem to show faster progress in word-level literacy, and process language at the level of the phoneme earlier, than those learning a less regular orthography (Seymour et al., 2003). The view that English is less transparent (i.e., the relation between written form and language sounds is less clear) than most other orthographies has led some to question the universality of current English-language derived theories about literacy learning (Share, 2008). Therefore, research on other languages/orthographies is needed to confirm the current models of reading. (Relevant research findings will be reviewed in Chapter 2 to provide a theoretical framework for the studies reported in this thesis.)

Persian orthography (see Chapter 3 for a review) has some interesting features that may lead to skills developing differently from those predicted by current models of reading derived from English. In contrast to English, but similar to Semitic languages (e.g., Arabic), the Persian orthography is written from right to left. The orthography is a modified version of the Arabic orthography, though it has more graphemes than Arabic. Interestingly, the Persian language has fewer phonemes compared to Arabic, which is one reason for Persian having a polygraphic orthography, meaning that several graphemes are used to represent the same phoneme. The orthography is cursive, with most letters changing their shape when connecting to letters preceding or following them. It also uses combinations of dots and marks within and around basic symbol shapes to distinguish letters/determine pronunciation, as well as to represent syntactic rules and morphological forms. In addition, several such

marks are used to represent short vowel sounds and these vowel markers are not always included in written text, particularly in passages targeted at more experienced readers. This elimination of short vowel markers leads to a reasonably large number of homographic letter strings in written Persian and means that, after first grade, Persian children need to learn to infer short vowel sounds from the context within which a word is written in order to obtain the correct pronunciation and meaning of a homograph. In addition, there is no written indication for diphthongs (combination of two vocalic phonemes in one syllable to form one phoneme) in Persian; diphthongs are represented by those letters which represent long vowels. Therefore, the learning of skills related to text comprehension may be a vital part of literacy learning at an early age for most Persian children.

Additionally, the form of Persian used in written text may not be the same as that spoken in every-day conversation by an individual. For example, the Persian accent varies across regions in Iran and, although it is the language of education in regions such as Kurdistan, Lorestan and Azerbaijan, Persian is not the home language. In Iran, Persian is called Farsi (the Arabic equivalent for Parsi, i.e. 'Persian', derived from the name of a historically important region of Iran), whereas in Afghanistan, it is called Dari and the accent used in the two versions varies. The written form used in all these areas, however, is based on a standard form of Persian. In addition, the spoken form of the language has a lot of substitutions (for example, نان /nan/ meaning bread becomes /nun/ in spoken form of Tehrani Persian) which makes the written form of words sound quite different from how they are spoken in normal every-day speech. Such forms of diglossia may lead to the influence of phonological processing differing in literacy development compared to other contexts where written and spoken languages are based on identical sound forms.

The current study endeavoured to investigate relevant cognitive-linguistic skills as potential predictors of Persian reading comprehension levels and aimed at the following general themes:

1. To investigate underlying cognitive skills as potential predictors of Persian reading comprehension in order to develop a Persian model of reading comprehension among primary school age children.
2. To verify the developed model among bilingual Persian-English speakers who use English as their dominant language meaning that Persian can be considered as their second (less dominant) language despite it being the language most widely used in the home environment.
3. To investigate the potential sources of reading comprehension deficits/difficulties of Persian learners in order to help educators identify and further support those at risk of reading problems.
4. To assess the usefulness of English-derived theories/models of reading (such as the SVR) for explaining literacy acquisition in other orthographies and, thereby, inform the development a universal model of reading despite differences between orthographies.

The following section describes the assessment battery used in the study along with the research methodology employed in a series of three experiments designed to address the areas of the focus of this thesis.

1.2 Assessment battery

The measures used in the current study were: the Reading Comprehension Questions (reading passages followed by questions about the text), and the Reading Comprehension Cloze

procedure (sentence completion) task, which were considered as indicative of text reading comprehension ability; the Listening Comprehension task (answering comprehension questions for orally presented passages), and the receptive vocabulary task (selecting a picture that best illustrates the meaning of an orally presented stimulus word) a commonly used measure of oral language ability; the Sound Deletion task (deleting a sound from a spoken word: 'cat without the /c/ sound' – English examples are provided for ease of understanding, though all tasks were presented in Persian), and the Non-word Reading task (naming a novel letter string: 'spoog') considered as indicative of phonological-based word decoding skills; the Matching Words task (saying whether pairs of letter strings were the same or different, where the different pairs differed by one letter/grapheme: 'sand send'), the Word Chains task (indicating random real words in a text where the spaces between words have been removed: 'thehelptimeafterman'), the Orthographic Choice task (selecting the correct spelling amongst letter strings that were real words or made-up words but sounded like real words if translated using spelling-sound conversion rules: e.g., 'monk munk') considered as indicative of the orthographic knowledge; and the Rapid Atuomaized Naming (RAN) of Words and Objects (naming familiar words or drawings of objects presented on a card as fast but accurately as possible), which were considered as indicative of the speed at which the child could access to phonological representation of words and objects (i.e., speed of general cognitive processing).

The measures were developed so that predictors of Persian reading comprehension could be examined in three studies reported in the thesis. Study 1 examined the predictors of Persian reading comprehension among monolingual Persian children; Study 2 verified the predictors among Persian-English bilingual cohorts; and the third study reported analyses aimed at investigating Persian reading comprehension difficulties.

The measures for Study 1 were modelled on those developed in other languages to investigate predictors of reading comprehension utilizing the same psychometric procedures (see Chapter 4, for developing measures). The English measures for Study 2 were either standardized tests or modified forms of these tests in English (see Methodology section in Chapter 6). As will be reported in the following chapters, overall the measures proved to be inter-related and suitable for the purpose of this thesis and led to proposing the Persian model of reading comprehension.

1.3 Study 1: Predictors of Persian reading comprehension

This study aimed at investigating predictors of Persian reading comprehension and developing a suitable model to explain text comprehension processes in the Persian orthography.

The study investigated the underlying cognitive-linguistic skills of Persian reading comprehension in order to develop the Persian reading comprehension model. It also aimed to assess the usefulness of the simple view of reading (SVR) (Gough & Tunmer, 1986; Hoover & Gough, 1990; Tunmer & Chapman, 2012) and/or the component model of reading (CMR) (Joshi and Aaron, 2000) in explaining the acquisition by primary school children of the Persian orthography which, at least in its fully vowelized form, is believed to be relatively transparent. Given these models, the study assessed the contribution of word-level reading and language understanding skills to Persian reading comprehension by identifying predictors of variability in reading comprehension. Persian is a language/orthography that has been scarcely studied but has characteristics that make the assessment of text processing potentially informative about universal theories of reading comprehension. Hence, the

identification of predictors of variation in Persian reading comprehension should inform further models across languages.

Study 1 assessed predictors of variation in Persian reading comprehension through a cross sectional design by measuring skills amongst grade 2 to 5 primary school children (N=232) attending mainstream schools in Iran. The concern here was not with between-group comparisons, but investigation into the relative contribution of several theoretically relevant abilities (cognitive-linguistic processes) to the prediction of text comprehension skills in a typical group of monolingual learners who were acquiring Persian literacy skills as part of normal mainstream schooling – a method that has been used to inform models of English reading comprehension (e.g., Adlof, Catts, & Little, 2006). Data analyses were used to determine whether the targeted underlying cognitive-linguistic (i.e., verbal skills, phonological skills, orthographic skills and speed of processing) were significant predictors of Persian reading comprehension.

Analyses from this study indicated that Persian reading comprehension levels are best predicted by measures of linguistic processing and decoding ability, with the latter being predicted by phonological and orthographic processing skills. Orthographic knowledge directly predicts Persian reading comprehension from an early grade and speed of processing is significant in older grades. These findings are discussed in terms of the application of the Simple View of Reading (Gough & Tunmer, 1986; Hoover & Gough, 1990; Tunmer & Chapman, 2012) to Persian. The findings also contributed to the development of the Persian reading comprehension model which is presented in Fig. 5.1 (Chapter 5).

1.4 Study 2: Verification of the developed model

Study 2 aimed at evaluating the developed Persian model of reading proposed in this thesis (Study 1). The data for this study was collected from Persian-English bilingual primary school children (N=126) in New Zealand and Australia who, similar to Study 1, performed on text reading comprehension measures along with other measures of linguistic comprehension, decoding/phonological skills, orthographic skills and speed of processing in both languages (i.e., Persian and English). The Persian tests were those that were developed for Study 1 (as presented in Chapter 4) and the English measures were standardized tests in English with some modifications.

Analyses from this study supported the Persian model of reading developed in Study 1, suggesting that orthographic measures predicted literacy skills from an early age, arguing for the possibility that Persian orthographic knowledge is an important early skill for an individual to read accurately/fluently and comprehend written text. However, in contrast to the monolingual data, analyses across grades indicated that lower grade children tended to rely more on orthographic knowledge to process decoding whereas for older children there was an increasing trend for phonological skills to be influential: in the Persian monolingual data, both skills areas seem to be predictive across grade levels. In contrast, speed of processing showed evidence of growing as a predictor of reading comprehension levels across the grade levels studied in the Persian monolingual data, but this trend was not evident in the bilingual findings where speed of processing seemed to show little influence on comprehension levels. However, in both data sets, speed influenced word decoding skills.

Despite these differences, overall, the findings confirmed the Persian reading comprehension model proposed in Chapter 5 of this thesis.

1.5 Study 3: Persian reading comprehension deficits

The purpose of this study was to investigate the sources of difficulties that hamper successful understanding of Persian text. The study aimed to investigate influences of word-level and understanding-level processes along with the element of speeded access to the phonological representations of words or objects on Persian reading comprehension deficits by contrasting the performance of average comprehenders with those who showed difficulties in their text reading comprehension. This provided an opportunity to examine the usefulness of the Persian model of reading proposed in this thesis (Chapter 5 – Figure 5.1) in identifying deficits of underlying cognitive skills of those with text comprehension problems.

In order to examine the ability of the model to explain reading comprehension deficits and learning difficulties, additional analyses of data collected as part of study 1 were conducted (these are reported in Chapter 7). Analyses of covariance compared the performance of individuals with (15% bottom low, N=33) and without below average (N=173) performance in reading comprehension (Cloze and Comprehension Questions) in Persian.

The findings supported the Persian model of reading presented in this thesis suggesting that children with comprehension problems (lower than the expected average level) have difficulties in language related skills, particularly listening comprehension, as well as their word recognition skills. The analyses further suggested that deficits in the lexical pathway, either phonological or orthographic, may compromise the semantics pathway (possibly within the triangle model framework see Plaut et al., 1996) and lead to text reading comprehension deficits. These findings can be used to inform the development of assessment tools, although further research is required to confirm causal relationships between the factors identified in this study.

1.6 Towards a universal model

For the past few decades, numerous models of reading have been proposed aiming at describing and explicating the essentials of reading processes. Findings of reading research support the idea that relationships between underlying cognitive skills which predict literacy learning skills have been found across a number of languages. It is also supported that reading processes depend on the language of the reader and the writing system that encodes that language (Perfetti, 2001). Therefore, Chapter 8 aimed at presenting general theoretical discussions of the findings of the studies reported in this thesis which may inform the development of a universal model of reading. It also presents the practical aspect of this work which should support educators in their day-to-day classroom teachings. Finally, limitations of this research and future work are discussed.

Chapter 2

Psychological Models of Reading

2.1 Introduction

Comprehension is the ultimate goal of reading. It is obvious that reading comprehension is more than a simple matter of recognizing or understanding individual words, and is a complex process. All models of reading comprehension thus acknowledge the active role of readers to build up a mental representation of what they read. To comprehend a text, readers are required to successfully go through several processes including, but not limited to, comprehension skills at word-, sentence- and text-level, integration of general world knowledge, appreciation of text structure, motivation and interest, and metacognitive abilities. In other words, a process that integrates a range of sources of information, from lexical features through to world knowledge seems essential for text comprehension (Snowling & Hulme, 2007).

To provide a better understanding of the processes involved in reading comprehension, many theoretical models of reading comprehension have been proposed in the past few decades; these include more elaborated models, such as the construction-integration model (Kintsch, 1998), to the relatively simple models, such as the simple view of reading (Gough & Tunmer, 1986; Hoover & Gough, 1990; Tunmer & Chapman, 2012). The core of all these models is how to decode the graphic symbols on the page to comprehend texts. Hence, decoding the written form of the language (script or orthography) which begins with the word recognition process has received a great deal of attention in the literature with many models explicating word recognition processes; in particular dual-route model (Coltheart & Coltheart, 1997) and the triangle model (Plaut et al., 1996) feature prominently in the literature. These models of

reading comprehension and word recognition are expounded in the following sections to provide theoretical frameworks for the current study. This Chapter also attempts to explore the cognitive skills involved during early reading acquisition with the focus on the relationship between oral language and the written form of the language to highlight the need of the move towards a universal model of reading.

2.2 Models of reading comprehension

This section provides general background knowledge of reading comprehension models from different spectrums (i.e., top-down process, stage models and bottom-up process) to highlight the complexity of research on reading comprehension. The final parts of this section explain the simple view of reading and the component model of reading; the two models of reading comprehension that are used as general guidelines throughout the thesis.

2.2.1 Constructionist models of reading comprehension

From the viewpoint of a constructionist theory, text comprehension can be achieved through a process at different levels. The reader must decode graphic symbols on a page; then, utilize perceptual processes, word recognition and parsing (recognizing words' component parts of speech and their grammatical role in a sentence or phrase); and finally, run semantic analysis to comprehend the word meaning based on the text they read (Kintsch, 1988, 1998). Kintsch (1998) proposed that to comprehend the written text, readers are required to construct multilevel representations of the text (i.e., microstructure and macrostructure). Microstructure level of the text plays a role at the word level which lends itself to a higher order unit of the text to comprehend global topics and their relationship. This higher order level is called macrostructure in Kinstch's model. These two levels (at the text level) activate the meaning

of the text. The meaning being purely derived from the text seems to be shallow with the deeper meaning of the text masked. Therefore, the text content must form a situational model. In other words, a mental model is formed by the situation described in the text. This leads to uncover the deeper meaning of the text. In short, the process can be summarized as two major levels of representations: (i) a text base representation that represents the linguistic structure of the text and its meaning; and (ii) a situational model or a mental model of the situation described by the text.

Several other proponents of constructionist models including Kintsch himself further developed these models leading to the construction-integration (CI) model of Kintsch (1998), and the landscape model (van den Broek, Risden, Fletcher, & Thurlow, 1996). These models are considered both bottom-up and top-down models; bottom-up models, because the reader must first decode the text to be able to start comprehension processes and top-down models because the reader must develop the situation model which depends on prior knowledge, vocabulary, and activation of relevant schemata (Langer, 1984).

The CI model seem to best capture adult reading comprehension but in terms of children, they fall short in defining how children develop skills at text level or situation/mental model; it is also unclear about how children construct a situational model since prior knowledge should play a crucial role in the process. In addition, these models do not imply how the reader can integrate the two major levels (text base and situational/mental model) which seem essential for comprehending the reading passage (Paris & Hamilton, 2009). Therefore, it is necessary to investigate the process of comprehension and not just the end product of comprehension, as suggested by such models. To address this area, researchers have proposed models such as stage models and information processing models of children's

reading development. The next section considers some of these models to provide general understanding of the process of reading comprehension informed by research in the literature.

2.2.2 Stage models of reading development

Developmental theories focus on the effects of age on skill acquisition. Changes with age are seen as biologically and/or culturally determined, with important roles being played by genetic and educational influences (Firth, 1985). These theories try to define how and in what order texts can be comprehended and comprehension skills can be acquired. In fact, the order in which skills can be acquired is particularly important for the theories that focus on stages of acquisition. Several researchers have tried to model stages that are involved in reading comprehension, among them are the models proposed by Chall (1996) and Ehri (1995). Chall's stage model of reading (1996), as an example of stage models, defines the process of reading comprehension in six stages. The model states children acquire skills in a linear and sequential manner starting with pre-reading skills, decoding skills and then text comprehension. These stages are summarized below:

Stage 1: At preschool, pre/emergent readers are learning skills such as concepts of print, letter knowledge, Phonological awareness, and book handling.

Stage 2: At grade 1 and 2, early readers learn to develop decoding skills such as letter/word recognition as well as letter/sound correspondence.

Stage 3: At about grades 2 – 3, decoding ability is expected to be consolidated, sight vocabulary to be built and reading fluency to be increased, which leads to improvement of reading accuracy.

Stage 4: At about grades 4 – 8, this stage is marked by a fundamental shift from 'learning to read' to 'reading to learn'.

Stage 5: At this stage, the focus of the reader is on comprehension skills by reading about different views on the same subject.

Stage 6: At this stage, the reader is able to comprehend different views about the same subject matter and successfully synthesize them.

Chall's model, in contrast with the constructionist models, attempts to capture reading processes from a fairly young age but it has been criticized for its focus on children acquiring skills/processes through a prescribed sequential, rather than overlapping order. For example, it cannot be stated that while children are acquiring decoding skills (stage 2), they are unable to show any indication of 'reading to learn' (stage 4) in certain contexts (Paris & Hamilton, 2009).

The two example models (the constructionist model and the stage model) presented so far have highlighted the complexity of reading comprehension. To deal with this complexity, the idea of the simple view of reading (SVR) was first proposed by Gough and Tunmer (1986) which provides a feasible theoretical ground as the basis for reading research and is considered as one of the most influential reading models in the literature with a high number of citations. The SVR was later introduced by Hoover and Gough (1990) and recently confirmed by Tunmer and Chapman (2012). This model has provided the basic theoretical framework for the current study.

2.2.3 The simple view of reading (SVR)

Reading comprehension is a complex cognitive process. This complexity can be addressed by defining the process as of making meaning from script by encoding the written form of the language (orthography) through a combination of graphic symbols (in alphabetic languages, letters) and map it onto the language. The simple view of reading (SVR) (Gough & Tunmer, 1986; Hoover & Gough, 1990; Tunmer & Chapman, 2012) is useful for studying the process of the reading in a rather bottom-up model. The model separates the variables pertaining to reading success into two elements. One element consists of those skills related to printed word recognition/decoding skills which comprise the visual, visual phonological and visual morphological mapping skills that are needed to productively derive word meanings from print representations. The other element includes the many factors that reading shares with language, such as vocabulary, syntax, semantics, and pragmatics. This is called linguistic comprehension. The SVR aptly argues that reading comprehension (R) is the product of decoding (D) and linguistic comprehension (L) (the formula used in the model is R = D x L). When decoding and linguistic comprehension are properly measured, they should account for all of the variance in reading comprehension. That is, reading comprehension can be broken into two component sets of skills: linguistic skills, which can be assessed with measures such as listening comprehension, and decoding skills that can be assessed by measures of isolated word/non-word reading accuracy and fluency.

Gugh and Tunmer define linguistic comprehension as "the process by which given lexical (i.e., word) information, sentences and discourses are interpreted" (Gough & Tunmer, 1986, p.7). These researchers also define decoding as more than simply 'sounding out' words. To them, decoding is somehow closer to word recognition skills, in that, skilled decoders are able to decode isolated words quickly, accurately, and silently; decoding differs from word

recognition, though, because word recognition skills (in alphabetic orthographies) are involved with letter-sound relationships to a large extent. (Letter-sound relationship will be explored later in the chapter focusing on other orthographies with varying levels of phoneme-grapheme correspondences.)

The idea of the simple view of reading was first proposed by Gough and Tunmer (1986) in an attempt to define the role of decoding in the process of reading comprehension. Gough and Tunmer believed that if decoded words can be understood, then the text is expected to be successfully read and understood. Thus, both decoding and understanding are necessary to explain a large amount of variance in reading comprehension. As an example, a typical English reader with no knowledge of understanding the Italian language may be able to decode words written in Italian but since they cannot understand the decoded words; reading comprehension does not take place. Hoover and Gough (1990) put this idea into an experiment and conducted a longitudinal study assessing bilingual Spanish-English children (N=254) from grades 1 to 4. They assessed these children in their word recognition and listening comprehension skills. They reported that the model was able to explain 72 to 85 percent of the variance in the reading comprehension. This result was supported by Adolf, Catts, and Little (2006), from their cross-sectional study on grades 2, 4 and 8. They reported that word recognition and listening comprehension collectively accounted for a large amount of the variation (almost 100%) in reading comprehension.

Very recently, Tunmer and Chapman (2012), replicated a similar study with 7-year-old children (N=122) and confirmed the SVR as a two component model by considering decoding and language comprehension measures as the two main component skills to predict reading comprehension. They also reported that vocabulary and listening comprehension were highly loaded on the linguistic comprehension factor in their factor analysis. Thus

listening comprehension and vocabulary knowledge should be treated as the constituents of the linguistic competence in the model.

Numerous studies have tried to add weight to the SVR by investigating the role of linguistic comprehension and decoding skills in the development of reading comprehension. The amount of prediction accounted in the reading comprehension changes during the course of reading development. In the early years of learning reading skills, it seems that the two components (listening comprehension and decoding) are quite separate as the child utilizes all their available processing resources in decoding with leaving very little for text comprehension. Older children (e.g., as old as Grade 8 children) show the opposite pattern through high correlation between the two components (linguistic comprehension and decoding) considering linguistic comprehension as the dominant predictor of reading comprehension (Catts & Kamhi, 2005).

The SVR also seems applicable to other orthographies. Joshi, Tao, Aaron and Quiroz (2012) compared Spanish, with a transparent orthography, and Chinese, with a complex orthography among primary school children. They reported that the components of the SVR (decoding and linguistic comprehension) could explain about 60 percent of the variance in reading comprehension among Spanish children at grades 2 and 3. They also reported that character recognition and listening comprehension explained 25 and 40 percent of the variance in Chinese reading comprehension at grades 2 and 4 respectively. The same results have been reported by Florit and Cain (2011) who examined validity of the SVR for beginner readers of English and other, more transparent, orthographies. They replicated the influence of the SVR components (decoding and linguistic comprehension) in reading comprehension of different orthographies. However, decoding was found more influential than linguistic comprehension for beginner readers of English than those of more transparent orthographies.

In terms of reading difficulties, different types of difficulties contributing to reading comprehension can be explained by the SVR. Aaron, Joshi, & Williams (1999) studied 198 students in grades 3, 4 and 6 and reported that about 8% of the students had either problems in decoding skills or linguistic comprehension skill. They also found that another 8% of the students had problems in both skills (decoding and listening comprehension). Similar findings illustrating that poor readers are not alike are reported in the literature, too (see Catts, Adlof, & Weismer, 2006, for a review).

Although the SVR makes research on cognitive skills and the components involved in reading comprehension feasible, what it does not explain (nor purports to explain) is breaking down the component predictors (linguist comprehension and decoding) to their constituents and investigating the interactions of other variables, including vocabulary knowledge, motivation, and cultural background of the reader to the product model (Aaron, Joshi, Gooden, & Bentum, 2008). It should be admitted that in a very recent study, Tunmer and Chapman (2012) have attempted to address this issue to some extent. For example, a vocabulary measure has been introduced to the model and included in the linguistic comprehension component. In addition, the model lacks specificity in defining the process of decoding and the interaction between the letter-sound knowledge (phonological skills), speeded access of the phonological representations of words or general cognitive speed, and knowledge of the orthography.

To address some of these shortcomings, some other models such as the component model of reading (CMR) (Joshi & Aaron, 2000) have been proposed. The CMR approves the core product of the SVR (reading comprehension=decoding x linguistic comprehension) and suggests the speed of processing as an independent component to be added to the model. The

next section defines the CMR and its components along with other research findings related to this model.

2.2.4 The component model of reading (CMR)

Joshi and Aaron (2000) explored the role of speed in the process of reading comprehension and proposed the component model of reading (CMR) by adding speed to the simple view of reading. They assessed listening comprehension and decoding skills of third grade children (N=40) and found that the simple view of reading explained nearly half of the variance (48%) in reading comprehension. They added a measure of speed of letter naming to the study which explained a further 10% of the variance. Their findings led these researchers to propose a modified version of the SVR by adding speed to the formula of the product of reading comprehension. The formula used by these researchers, similar to the SVR, is: reading comprehension=decoding x linguistic comprehension + speed (R = D x C + S).

The CMR treats decoding as a basic requirement of word recognition skill. Since older children (at about grade 4) can build up sight word reading through their decoding skill, sight word reading is considered as an emerging skill included in decoding (Aaron, Joshi, Ayotollah et al., 1999). The difference between actual decoding (through sounding out graphemes) and sight word reading is that "sight word reading is considered as a speeded up decoding process; that is, Decoding + Speed = Sight Word Reading" (Joshi & Aaron, 2000, p. 87).

Speed was not used as a multiplier of the product in the CMR and was added to the product instead since the advocates of the model were uncertain about the status of speed as an independent component skill. It can be explained by children relying more on decoding

which is closely associated with reading skill in the early years of learning reading skill. Consistent with Chall's stage model of reading (1996), once readers have consolidated their decoding skills and built sight vocabularies, reading fluency takes place by having speed emerging as an important factor.

The speed index in the CMR, as a fluency index, is computed through dividing the total number of the words read correctly by the time taken. The fluency index is used rather than scores obtained in the word reading measure, the rationale being: (i) children with a faster rate of reading are likely to take less time to read the words and slower readers are prone to take a longer time to read the same number of the words. Thus, the fluency index helps give higher scores to the good readers and lower scores to the slower ones which is more practical to be included in the model; and (ii) the ceiling effect is usually observed in higher grades since children at about grade 5 can likely read almost all words correctly. Thus, the fluency index may represent a better image of the ability of the child to decode words or non-words fluently and is not restricted to the child's grade.

In another attempt, Aaron, Johsi, Gooden and Bentum (2008) further investigated the CMR, studying the performance of 240 children from grade 2 to 5 on the cognitive skills reported as the constituents of the model. They concluded that speed of processing contributes to reading between 2.5% and 8% in different grades tested. The effect of the speed of processing, as defined by Aaron et al., appears to diminish in higher grades (grade 5) which is because proficiency levels for higher grades children "makes it difficult to isolate the effect of fluency from that of word recognition" (p.73).

The CMR, similar to most psychological theories, has not gone unchallenged. Adlof et al. (2006) studied 522 children from grade 2 to 5 assessing them on many tests of reading skills

which could explain 97% of the variance in reading comprehension. Their findings, similar to the findings from the SVR, were at odds with the CMR and indicated that fluency needs not to be considered as a separate component to the model of reading. Similarly, Hawelka and Wimmer (2005) studying Chinese-, Korean-, and English-speaking children reported that rapid naming did not add to the level of predictions. These findings suggest that speed of processing is a basic resource in all tests of cognitive skills (Cho & McBride-Chang, 2005).

The controversy alluded to might be explicated a bit further, along with rationale provided for assessing RAN with a variety of tasks (c.f., Schatschneider et al. 2004). In the research reported in this thesis, speeded access was assessed using measures of Rapid Automatized Naming (RAN) of letters, words, colour and objects to address the controversy exists in the literature.

2.2.5 Summary of reading comprehension models

In most models of reading comprehension, such as the construction-integration model (Kintsch, 1988, 1998) and the stage model (Chall, 1996), word identification is initiated by graphemic encoding of the word, and access to word meaning is then achieved either directly from this graphemic code or via a phonological code. Once the individual words in a phrase have been successfully recognized/decoded, the reader is expected to comprehend the meaning of the words in context. Thus, understanding the decoding process by determining the skills involved in these graphemic or phonological processes is essential. Similarly, the simple view of reading and the component model of reading consider reading comprehension through understanding of the language and decoding ability of the written language which maps onto the language understanding. These two components are unanimously recognized

for successful reading comprehension levels (e.g., Aaron et al., 2008; Adlof et al., 2006; Catts et al., 2006; Joshi & Aaron, 2000; Tunmer & Chapman, 2012).

The SVR and CMR outlined here have a great deal of intuitive appeal. It is clear that reading comprehension cannot take place without identification of words and the retrieval of meanings. However, to understand reading comprehension, each of the components needs to be understood fully. Similar to the reading comprehension models, numerous theories and models of word recognition have been proposed in the past few decades. The next section describes the dual-route model (Coltheart, 1985) and the triangle model (Plaut et al., 1996) as two of the most widely studied models of word recognition.

2.3 Models of word recognition

Hoover and Gough (1990) posited the print-dependent component as a measure of decoding skill and defined it as efficient word recognition in the simple view of reading. They (1986) originally defined decoding skill as the ability 'to read isolated words quickly, accurately and silently' (p.7). In broader terms, learning to read is learning how one's writing system encodes one's language (Perfetti, 2001). This claim reflects the view that reading is fundamentally about converting graphic input (letters, words, characters) to linguistic-conceptual objects (words, morphemes, and their associated concepts) (Perfetti & Zhang, 1995). Typically in the context of an alphabetic writing system, decoding refers to the ability to sound out letters by applying grapheme-phoneme correspondence rules. To decode, one needs to establish a grapheme-phoneme correspondence followed by chunking common spelling patterns which helps to retrieve words from memory. Therefore, a vital part of this process is the ability to recognize language sounds (i.e., phonological information). In fact, word reading/recognition is the preliminary stage of successful reading and it seems that

word recognition models tend to explicate how the reader accesses the pronunciation of a letter string with less research on access to meanings to this date (Cain, 2010). The next section explains two influential models of word reading: the dual-route model (Coltheart, 1985; Ziegler & Jonathan, 2011) and the connectionist/triangle model (Plaut et al., 1996; Seidenberg & McClelland, 1989) to further fortify the theoretical foundation of the research reported in this thesis.

2.3.1 The dual-route model

The dual-route model proposed by Coltheart (1985) suggests that there are two routes in word recognition process: the direct route and the indirect route. The direct route, also known as the lexical route, involves deducing the meaning of the words from their visual form (sight word reading). Words that are learnt by the reader are stored as an entry in a mental dictionary or inter lexicon. Thus, the visual representation of the word (letters are considered as visual cues) or written form of the word can activate its meaning through this direct route. However, the association between the written form of the word and its meaning is arbitrary and must be learnt through experience (Coltheart, Curtis, Atkins, & Haller, 1993).

The indirect route, also known as the non-lexical or sub-lexical route, involves phonological processing which implies that the reader applies grapheme-phoneme correspondence rules to relate the letters to their corresponding sounds in order to produce word pronunciation through which access to the lexicon is provided (Coltheart, 2006). Thus, the phonological route indirectly relates a written word to its meaning.

The dual-route model is supposed to explain not only normal reading and word recognition process, but also uncover facts about reading disorders. Since the model proposes that word

recognition takes place via the lexical/direct route and the non-lexicon/indirect route, reading disorders can be explained using this model well. Knowledge about spelling and pronunciation of real words are stored in mental lexicon, thus the information about a word can be accessed via the lexicon route, whereas reading via the non-lexical route means reading through utilizing grapheme-phoneme correspondence rules (any letter or letter sequence that represents a single phoneme is known as grapheme). Studies on reading disorders experienced by people with brain damage or surface dyslexia showed two different routes for word recognition. People with brain damage could read words through a non-lexical route. For example the word ‘have’ would rhyme with ‘cave’ (see Coltheart, 1996, for a review on such studies). Thus it can be subsumed that deficits in word recognition processes can be reliably examined by this model.

2.3.2 The triangle/connectionist model

The triangle model is a connectionist model of word reading (Plaut et al., 1996) which is often presented as an alternative to the dual-route model. Connectionist models have been developed as models of how the brain might learn and represent information. These models are known as neural networks and are believed to be biologically inspired or neurally plausible. These models are also believed to be based on back-propagation (Cain, 2010) which means that all sources of information work side by side in a parallel mode while supporting one another.

In the triangle model of Plaut et al. (1996), reading words involves computation of three types of codes: orthographic, phonological and semantic. The model, rather than looking at different pathways, assumes readers simultaneously use phonological, orthographic and semantic information no matter what type of word they are attempting to read. This means

that there is an interaction of a phonological pathway mapping between letters and sounds as well as a semantic pathway which maps between letters and sounds via meanings. Within the framework of the triangle model, semantic representations should influence word reading. Thus, it can be assumed that words that are more familiar in meaning are to be read with greater ease than the words that are less familiar in meaning.

It seems that children at early stages of learning to read rely more on the phonological pathway and later they rely more on word meaning and gain fluency in their reading which can be interpreted as more reliance on semantic pathway (Snowling, 2004). The later stage – relying on the semantic pathway – is necessary in order to be able to read words when grapheme-phoneme correspondence rules fail due to the complex nature of the orthography, such as exception words in English.

2.3.3 Summary of word recognition models

As discussed, within the framework of reading comprehension models, such as the SVR and CMR, reading starts with decoding the written form of the language. Hence, understanding of how words are decoded is useful to give researchers a hint of how the written form of the language (print) can be decoded into sounds or meaning.

Word reading processes as explicated by the dual-route model and the triangle model are through phonology or orthography. Both models suggest that words can be read either through a lexical route or a non-lexical route. The two models are different, though, in terms of their process. The dual-route model suggests a serial manner processing with two discrete routes and the storage of word knowledge as lexicon entries. The triangle model, in contrast, suggests that word recognition process is parallel. Similar to the dual-route model, the

triangle model also involves two routes, a direct route and an indirect route. The direct route is via orthography-phonology, and the indirect route is via semantics (Coltheart, 2005).

Similar to the dual-route model, the triangle model of word reading can account for many reading difficulties explaining the facts about reading disorders. Both models are useful in depicting isolated word recognition process. However, the application of both models, similar to models of word recognition, in research focusing on the meaning and context is scarce (Cain, 2010).

Since the ultimate goal of reading is to understand the written form of the language, investigation into cognitive skills involved in text comprehension seems essential to develop models of reading comprehension. The next section of this chapter firstly deals with the cognitive skills involved in reading comprehension at the word-level, consistent with the SVR and CMR, and then rationalizes the importance of studies in other orthographies (focusing on the grapheme-phoneme relationships in orthographies varying transparency) in an attempt to develop universal models of reading comprehension.

2.4 Cognitive skills of reading and their measures

As defined so far, reading comprehension can be enhanced through successful word reading and understanding of the language (Tunmer & Chapman, 2012). Research has shown that understanding of the language is the foundation of successful reading (Gough & Tunmer, 1986; Joshi & Aaron, 2000). The dual-route model and the triangle model of word recognition acknowledge that phonological and orthographic skills are prerequisite of skilled word reading. Similarly, Ehri (2005) emphasizes on a theory of sight word reading which involves forming connections between graphemes and phonemes to bond spellings of the

word to their pronunciation and meaning in memory. Thus, the knowledge of both sound system of the language (phonology) and the writing system of the language (orthography) are essential to be considered in successful reading. It is also important to consider the element of speed in the process as suggested by the CMR (Joshi & Aaron, 2000). In addition, it is of great appeal to know whether various grapheme-phoneme relationships in terms of consistency in other orthographies would impact successful reading (Frost, 2012).

In this section, language related skills, phonological/decoding skills, speed of processing and orthography will be explained as the areas of the cognitive skills of the focus of this thesis. The orthography section will also attempt to uncover the grapheme-phoneme relationship in other languages/orthographies highlighting the need of research in other orthographies rather than English to consolidate the current models/theories of reading (Frost, 2012; Share, 2008).

2.4.1 Language related skills

The simple view of reading (Tunmer & Chapman, 2012) refers to linguistic comprehension as one of the main component skills in reading comprehension. Linguistic comprehension refers to "the ability to take lexical information (i.e., semantic information at the word level) and derive sentence and discourse interpretations"(Hoover & Gough, 1990, p. 131). In other words, linguistic comprehension refers to the lexical ability to interpret sentences and discourse presented orally (i.e., understanding of the spoken language). Tunmer and Chapman (2012) argued that despite listening comprehension often being used as a measure of assessing linguistic ability, linguistic comprehension should not be mistaken as listening comprehension. Thus, measures of listening comprehension and reading comprehension must be in parallel forms and to be constructed as similarly as possible in terms of the frequency of words and degree of difficulties as well as global characteristics such as genre in order to

assess the same sorts of language understanding and not introducing anything new (Hoover & Gough, 1990; Tunmer & Chapman, 2012).

Various aspects of language skills such as vocabulary and grammar are likely to influence reading development via the linguistic comprehension component of the SVR. Vocabulary knowledge is likely to be important both in learning to recognize individual words (Nation & Snowling, 1998; Plaut et al., 1996) and in text comprehension (McKeown, Beck, Omanson, & Perfetti, 1983). Grammatical skills might also aid word recognition through the use of context and may contribute to the development of reading comprehension (Perfetti, 1985). In addition, a number of higher-order discourse skills are likely to contribute to the development of reading comprehension; including inference, metacognitive skills, and understanding text structure (Cain, Oakhill, & Bryant, 2004; Cain, Oakhill, & Lemmon, 2004).

Juel, Griffith and Gough (1986) have argued that although decoding (translation of print to linguistic form) is crucially involved in reading, it is not sufficient. These researchers believe that to comprehend the linguistic form represented in print, the reader needs to utilize the same mechanisms used in the comprehension of spoken language; that is, the same knowledge of morphology, syntax, semantics, and pragmatics. They also argued that the quality of reading comprehension depends entirely on the quality of reader's listening comprehension. Consistent with this argument, research shows that there is a strong relationship between reading comprehension and listening comprehension, especially as children grow older and reading comprehension becomes more constrained by knowledge and understanding, rather than basic word-level decoding(Gough & Tunmer, 1986; Hoover & Gough, 1990). In adults, listening and reading comprehension are strongly correlated (Bell & Perfetti, 1994). This relationship is so clear that some researchers even believe that, despite the important differences between spoken language and written language, it can be

reasonably argued that learning to read enables a person to comprehend written language to the same level as they comprehend spoken language (Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001).

In the SVR, consistent with most of the similar research, language comprehension was assessed by the listening comprehension measure despite the fact that language ability is more than just listening comprehension. This made some researchers to challenge the SVR by suggesting that some other elements of the oral language ability such as oral vocabulary should be considered in the assessment (e.g., Ouellette & Beers, 2010). Muter et al. (2004) assessed the importance of vocabulary knowledge of children's first two years of learning to read in a longitudinal study and reported the unique contribution of oral vocabulary in two separate aspects of reading: word reading and reading comprehension. Thus, vocabulary knowledge seems to be a good target to be involved in the assessment of oral language skills, being reported as a good predictor of reading comprehension after controlling for early word recognition, phoneme awareness and letter knowledge (Muter et al., 2004).

Logically, children need to know the words that make up a written text to fully understand the text they read (Ricketts, Nation, & Bishop, 2007). In addition, to be able to comprehend texts, the reader must have the ability to get context-appropriate meaning from words. In other words, knowledge of more words contributes to better comprehension (Perfetti & Hart, 2001). Research shows that the relationship between vocabulary and reading comprehension is likely reciprocal across development (Beck, Perfetti, & McKeown, 1982). Consistent with this, children with poor reading comprehension tend to show relatively low levels of vocabulary knowledge (Nation, Clarke, Marshall, & Durand, 2004).

These examples support the idea that vocabulary knowledge plays a relatively crucial role in reading comprehension. Ricketts et al. (2007) investigated vocabulary and literacy skills of 81 children aged eight to ten years. Through regression analysis, they demonstrated that oral vocabulary predicts reading comprehension. They found that oral vocabulary skills predict concurrent reading comprehension and exception word reading but not text reading accuracy, non-word reading or regular word reading. They reasonably argued that vocabulary knowledge plays a significant role in reading comprehension.

However, the role of vocabulary as an independent predictor of reading comprehension is controversial. Few studies have implemented measures of listening comprehension and vocabulary simultaneously to assess linguistic comprehension in a broader term and consider the contribution of the two skills as language related skills in reading comprehension (e.g., Braze, Tabor, Shankweiler, & Mencl, 2007; Sénéchal, 2006). Braze et al. (2007) evaluated the SVR for young adults and concluded that vocabulary significantly predicted reading comprehension beyond listening comprehension and decoding. In contrast, Tunmer and Chapman (2012), evaluated the SVR introducing receptive vocabulary to the model. They concluded that vocabulary should be considered as the constituent of the linguistic comprehension component in the model (see discussion in Tunmer and Chapman, 2012). Therefore, in the current study, measures of listening comprehension and receptive vocabulary were developed to examine the unique variance of the linguistic comprehension in text reading comprehension.

2.4.2 Decoding/Phonological skills

Reading and writing certainly requires knowledge of the language (e.g., English) underlying its print and spoken forms, and both skills require knowledge of the written form of the

language (orthography); that is, the rules that relate print to the spoken form (Frost, 2012; Goswami, 2012; Juel et al., 1986; Perfetti, 2012). Learning to read is learning how one's writing system encodes one's language. This claim reflects the view that reading is fundamentally about converting graphic input (letters, words, written characters) to linguistic-conceptual objects (words, morphemes, and their associated concepts) (Perfetti & Zhang, 1995). Thus, decoding letter strings into an internal phonological or orthographic form is required in the process of reading. Typically in this context, decoding refers to the ability to sound out the letters by applying the grapheme-phoneme correspondence rules. To decode, one needs to establish a grapheme-phoneme correspondence followed by chunking common spelling patterns which helps retrieve words from memory. Therefore, a vital part of this process is the ability to recognize language sounds (i.e., phonological information).

Ehri's theoretical model of skilled word recognition (1995) emphasizes the importance of phonological information in the reading process. Phonological skills involve the child's procedural knowledge about grapheme-phoneme correspondence rules which enables the reader to translate letters into their corresponding sounds and then to combine these sounds to read words. Elbeheri and Everatt (2007) aptly phrased phonological awareness as "children's ability to reflect process, conceptualize and manipulate the sub-lexical segments of spoken language such as syllables, onset and rimes, and phonemes" (p. 273).

Phonological awareness is essential in learning reading skills at all ages (Lipka & Siegel, 2007). Phonological skills have also been reported as strong predictors of early reading skills (Gillon, 2005; Puolakanaho et al., 2008). Research findings have indicated the importance of phonological skills in successful reading (Smythe et al., 2008). Data on second language learners (including English and Persian: the languages of the focus of this research) has also suggested that phonological skills contribute to literacy ability (Arab-Moghaddam &

Sénéchal, 2001; Geva, Wade-Woolley, & Shany, 1997; Gholamain & Geva, 1999; Grant, Gottardo, & Geva, 2011; Jean & Geva, 2009; Nassaji & Geva, 1999). In addition, many researchers confirmed that phonological awareness is a positive measure of early word recognition in various languages (e.g., Bowey, 2008; Nation et al., 2004; Smythe et al., 2008). Similarly, phonological awareness has been reported as an essential area of skills in successful reading in cross-language studies (e.g., Smythe et al., 2008).

Smythe et al. (2008) in a cross-language study amongst groups with five different language backgrounds (Arabic, Chinese, English, Hungarian and Portuguese) assessed the level of prediction of word-level literacy by measures that focused on different aspects of phonological processing. They found that phonological awareness explained a significant amount of the variance in word reading in all cohorts. In terms of differences between the orthographies, these researchers convincingly argued that a phonological decoding measure is a significant predictor of word reading in Arabic, English and Portuguese. They also concluded that phonological awareness and decoding are the best predictors of word-level literacy in Arabic and English. Their findings, consistent with similar research, suggests that Arabic shares similar features to English in the sort of underlying phonological variables that likely predict variation in basic literacy skills (Al-Mannai & Everatt, 2005; Elbeheri & Everatt, 2007; Elbeheri, Everatt, Reid, & Al-Mannai, 2006; Smythe et al., 2008). This similarity is of importance in the context of this thesis since the Persian orthography is a modified version of Arabic and is from the same family of language similar to English.

In a similar vein, Lee (2008), through application of a Malay reading-related assessment battery, found that phonological awareness is the best significant predictor of word-level reading skills in Malay, with rapid naming making independent secondary contributions. Decoding and listening comprehension made separate contributions to reading

comprehension, with decoding as the prominent predictor. Lee also concluded that, despite the differences in the Malay and English orthographies, there are striking similarities in the theoretical constructs of reading-related tasks in both languages (i.e., English and Malay).

Cross-language studies conducted in languages varying in orthographic consistency also demonstrate that although phonological awareness may be a common factor across languages, its ability to predict literacy levels varies with orthography (e.g., Everatt et al., 2010; Everatt, Smythe, Ocampo, & Gyarmathy, 2004; Georgiou, Parrila, & Liao, 2008; Seymour et al., 2003; Smythe et al., 2008). Moreover, the extent to which reading comprehension is mediated by phonological processes is subject to debate (Coltheart & Coltheart, 1997). Therefore, more cross-language studies on languages varying in orthographies (in terms of transparency) would be useful. (Orthography will be explained more in the following sections of this chapter.)

Decoding skills have been shown to predict reading comprehension in the reading comprehension models (e.g., the SVR and CMR). Early decoding is heavily dependent on letter-sound relationships; letter-sound knowledge is also essential to consolidate orthographic representations required for automatization of silent word reading or sight word knowledge (Ehri, 2005). Research shows four different ways to read words (Ehri, 1995). One way is reading through sounding out the letters (blending graphemes into phonemes) which is also called phonological recoding (Ehri, 1995). Analogizing is another way, when the reader uses their knowledge of the known words to read new words (Goswami, 1986). The third one is prediction (Tunmer, 1989). The fourth way is the sight word reading; sight word recognition is reading from memory which occurs when any word can be read sufficiently (Ehri, 2005). Thus, sufficient knowledge and experience of words may help the reader

recognize words automatically as they read text which helps focus on comprehension with no disruption.

2.4.3 Speed of Processing

In addition to the word level and comprehension level skills (i.e., verbal skills and phonological/decoding skills), the role of speed in reading processes has been recognized in the literature (e.g., the CMR: Joshi & Aaron, 2000). Joshi and Aaron (2000) explored the role of speed of processing in reading comprehension and reported that decoding and listening comprehension are good predictors of reading comprehension, similar to the SVR, while a measure of speed of letter naming should be included in the SVR.

However, there is a debate in the field regarding the relevance of speed of processing measures. For example, because many of the speed of processing measures involve speeded naming tasks, some researchers consider that rapid naming tasks should be considered as phonological processing tasks (Wagner, Torgesen, Laughon, Simmons, & Rashotte, 1993; Wolf & Bowers, 1999). Wagner et al. (1993) subsume speed naming as "retrieval of phonological codes from a long-term store" (p. 84). However, other researchers tend to assume naming speed tasks as related to cognitive speed, which can be considered as an indicator of general processing speed of the cognitive system (see Carver, 1991, 1997). Hence, interpretations of the same task can vary depending on whether one considers the measure as an index of general cognitive speed or as a more specific feature of phonological processing.

In addition, although there is a considerable number of studies, particularly with transparent scripts, that indicates that reading speed may be a more reliable measure of individual

differences in word level processing than reading accuracy (Wimmer, Mayringer, & Landerl, 2000), speed in these cases should be considered as a measure of word decoding fluency – or as indicative of automatic word reading. For a transparent script, accurate decoding can occur, but for the poor decoder, this may be time consuming, leading to poor levels of fluency in reading. Similarly, research shows that the speed of single word reading accounts for the substantial amounts of variance in reading comprehension performance (Perfetti, 1985). If a child has difficulty at the word reading level, these problems will logically have a negative impact on their reading comprehension level. In order to achieve meaning from the text, children are initially required to be fluent in decoding at the word level. Therefore, speed in this case is specific to the task of reading and again may need to be considered separately from measures of rapid naming.

However, rapid naming itself has been found to be related to individual differences in reading ability. Denckela and Rudel (1976) were amongst the first researchers to show that dyslexic children have impaired naming speed. These researchers developed the Rapid Automatized Naming (RAN) Test, which has become a standard form of assessment of naming speed. This test involves a visual array of stimuli (e.g., letters, numbers, colours, or objects) that are to be named as quickly, but as accurately, as possible (Denckla & Cutting, 1999; Wimmer et al., 2000; Wolf & Bowers, 1999).

That early rapid naming differences are predictive of later reading difficulties is reasonably argued by Wolf, Bally and Morris (1986). However, as Wimmer et al. (2000) state “One could reason that the role of the naming speed deficit tends to be overlooked in English-based research” (p. 668). These researchers believe that poor word recognition is the focus of diagnoses of reading disability in most studies and that the role of naming speed should be further examined in consistent orthographies. In their longitudinal research, Wimmer et al.

(2000) studied naming speed deficits in German-speaking children from the beginning of school to three years later. They found that, unlike English, naming speed deficits strongly affected reading fluency, orthographic spelling, and foreign-word reading. In a similar study, Hutzler and Wimmer (2004) found that in the German orthography, which is believed to be one of the relatively transparent orthographies, dyslexic readers suffer mainly from slow laborious reading and less from reading errors.

Therefore, because of its potential role in reading ability, particularly in more transparent orthographies, the present research has considered the role of speed in Persian. However, due to the potential different roles across reading fluency, phonological access and general speed of processing, several measures were included to attempt to separate these influences in the Persian orthography and further inform reading theories.

2.4.4 Orthographic skills

'Orthography' is the written representation of a language (Perfetti, 2007). For example, the English orthography and Italian orthography which both utilize alphabetic writing systems are quite different. Understanding of how an orthography represents any specific spoken language is of great appeal in reading research since reading is encoding graphic representation of one's language (Perfetti & Liu, 2005). Based on the relationship between the graphic representation of the language and its sound system, orthographies are classified as transparent/shallow or opaque/deep.

'Transparent or consistent orthography' refers to the relative ease of deriving phonology from orthography due to the near one-to-one association between letters and sounds. In contrast, an inconsistent or opaque orthography (such as English) has a poor correspondence between

written letters (graphemes) and language sounds (phonemes). For example, the English orthography is called polyphonic since graphemes can represent more than one phoneme. It is also polygraphemic because it includes some phonemes that can be represented by different graphemes. This is why the English orthography is known as a relatively deep or opaque orthography. However, considering Arabic as another example, with its 28-letter alphabet and 34 phonemes, it is believed to be a relatively transparent/shallow orthography because of its more consistent (one-to-one) grapheme-phoneme correspondence (Elbeheri et al., 2006).

Learning to read has been shown to be strongly related to early language skills in typically developing populations, particularly phonological processing abilities (Goswami & Bryant, 1990). It is also suggested that becoming a skilled reader depends on more than just phonological ability (Nation & Snowling, 2004). Some researchers have tried to describe reading as the product of two interrelated but relatively independent skills as decoding and linguistic comprehension (e.g., the SVR and CMR as explained in this chapter). In general, learning to read may be considered as the fundamental task of discovering how print or writing system maps onto the spoken language (Perfetti, 2001). However, the relationship between the written form and language varies across languages (Seymour et al., 2003; Ziegler & Goswami, 2005).

Research suggests that readers of transparent orthography can rely on grapheme-phoneme conversion, whereas readers of complex orthography would rely more on orthographic whole-word reading (Wimmer & Goswami, 1994). Similarly, the Orthographic Depth Hypothesis (ODH) (Katz & Frost, 1992) posits that word-reading processes are different across orthographies and writing systems and their consistency/transparency of their grapheme-phoneme correspondence affect word recognition processes. Shallow orthographies (e.g., Serbo-Croatian and Italian) are processed via the indirect/non-lexical

route (grapheme-to-phoneme correspondence) but complex orthographies require lexical procedures in their word recognition processes.

Reading development seems to be a slower process in complex orthographies (Seymour et al., 2003). Complex orthographies also require higher level of word recognition, consistent with what Perfetti et al. (2007) call *online* word processing. Despite research showing that reading processes depend on the language of the reader and the writing system that encodes that language, most of the reading models/interpretations on reading processes have been derived from studies of English speaking individuals; the writing system which is routinely criticized for the lack of one-to-one correspondence between phonemes (sounds) and graphemes (letter characters) (Share, 2008). In fact, the view that the English orthography is less transparent (i.e., the relation between written form and language sounds is less clear) than most other orthographies has led some to question the universality of current English-language derived theories of literacy learning (Share, 2008). Therefore, research on other languages/orthographies is needed to confirm the current models mostly derived from English.

2.5 Findings of reading research in different languages/orthographies

The level of the complexity of the orthography (lack of grapheme-phoneme consistency) suggests differences in literacy learning. Seymour et al. (2003) in their most ambitious cross-linguistic study, investigated letter knowledge, familiar word reading, and simple non-word reading of 14 orthographies and found that fundamental linguistic differences in syllabic complexity and orthographic depth are important in reading. They stated that syllabic complexity selectively affects decoding, whereas orthographic depth affects both word

reading and non-word reading. They also concluded that the rate of reading development in English is more than twice as slow as for shallow orthographies.

In a similar study, Georgiou et al. (2008) examined the concurrent and longitudinal predictors of word decoding and reading fluency in children learning to read in English as a deep orthography and Greek as a shallow orthography. They examined measures of phonological awareness, phonological memory, rapid naming speed, orthographic processing, word decoding and reading fluency of 70 Greek-speaking children and 110 English-speaking children in Grade 1 and 2. Their findings show that the best predictors of word decoding in English are phonological awareness and orthographic processing. However, the best predictor in Greek is Rapid Automatized Naming (RAN) while orthographic processing does not significantly contribute to the process.

Persian orthography is of interest because there is a relative one-to-one grapheme-phoneme correspondence in Persian orthography, particularly fully vowelized (texts aim at beginner readers, e.g., Grade 1 children) (see Chapter 3 for details on the Persian language and orthography). Thus, it can be assumed that decoding is relatively simple as it is evident in transparent orthographies. The complexities of the orthography increases in the absence of short vowel marks (texts aimed at experienced readers as old as grade 2 children are non-vowelized) which leads to the differences within the orthography (Arab-Moghaddam & Sénéchal, 2001; Baluch & Danaye-Tousi, 2006; Baluch & Danaye-Tousi, 2007; Rahbari, Sénéchal, & Arab-Moghaddam, 2007). It means that words with written form of the long vowels are still considered as highly transparent, whereas words written without the short vowel marks (short vowels are not always included in the orthography particularly texts aimed at expereinced readers) are highly opaque.

Arab-Moghaddam & Sénéchal (2001) studied bilingual Persian-English children who were originally from Iran and lived in English-speaking Canada for an average of four years to compare how phonological and orthographic skills contribute to reading and spelling for these two alphabetic languages (i.e., Persian and English) (similar to the research reported in Chapter 6 – Study 2 of this thesis). They tested 55 Grade 2 and 3 children on word reading and spelling in both languages. They found that in terms of reading performance, phonological and orthographic skills are similar across languages and each explains unique variance in word reading in English and Persian. However, Persian spelling is predicted by orthographic processing only. This is unlike English spelling which is predicted similarly by phonological and orthographic skills.

In a similar vein, Rahbari et al. (2007) examined the contribution of phonological and orthographic skills to Persian reading and spelling. These researchers tested reading, spelling, phonological and orthographical skills of a cohort of 109 Grade 2 Persian monolingual children in Iran. Consistent with the findings of Arab-Moghaddam & Sénéchal (2001), they found that both phonological and orthographic skills significantly explained the variance in reading. They also reported that phonological and orthographic skills can predict spelling among the Persian monolingual cohort at the same level. Differences between these two studies could be due to the different cohorts of children tested (i.e., monolingual versus bilingual groups) which argues for children to adopt a strategy to deal with the complexity of their orthographies (Firth, 1985).

Firth (1985) believes that differences in the degree to which children adopt a reading strategy may lie in differences in orthographic skills. The polygraphic feature of the Persian orthography (the orthography of the focus of the current work) also requires reliance on orthographic knowledge (Rahbari & Sénéchal, 2010). Thus, it can be assumed that readers

may adopt a strategy to deal with the complexities of their orthographies through their experience with reading, a strategy that is adaptive to its use of lexical pathway in text comprehension ability.

Considering the differences exist among orthographies, writing systems and languages, the question revolves around which model can best explicate reading processes through a universal spectrum. Frost (Frost, 2012) proposed a move towards a universal model of reading. He believes that since the aim of reading research is to explain reading processes across orthographies, it is valuable to consider common cognitive operations involved in orthographic processing in all writing systems. Similarly Perfetti's universal language principle (2003) posits that comprehension entails that written language encodes oral language at the word, sentence, and text levels. However, he admits the language of the reader and its writing system would influence reading processes (Perfetti, 2001). Thus investigations into other orthographies potentially contribute to a general understanding of reading process – perhaps another step forward towards building a universal model – as well as to increased understanding of the specific orthography under investigation.

2.6 Summary and thesis aims

The present research work focuses on Persian reading comprehension. However, consistent with those advocating cross-language studies to develop universal theories/models of reading (e.g., Frost, 2012; Goswami, 2012; Perfetti, 2012; Perfetti, Cao, & Booth, 2013), the findings/conclusions derived from the work on Persian can be considered in the context of theories/models of reading in general. Congruent findings identified across various orthographies should allow the move towards a universal model of reading (Frost, 2012).

In addition, reading researchers have developed theories of reading in various fields such as dyslexia, reading development, and skilled reading over the past 30 years mainly in English and mostly these findings have dominance over theories of reading used in other orthographies. However, English has been reported as an exceptional outlier orthography with low transparency and many inconsistencies and complexities (e.g., Share, 2008; Ziegler et al., 2010). This has led researchers to criticize the dominant English-driven models/theories of reading and demand for research on other orthographies to evaluate the current models of reading (Share, 2008; Frost 2012). In order to develop general theories of reading – perhaps a universal model of reading – it may be necessary to perform studies that do not focus solely on the English language/orthography (Seymour et al., 2003; Share, 2008; Ziegler et al., 2010).

Investigations of the Persian orthography are of interest in response to the demand towards a universal model of reading since the orthography has its own interesting features: it is polygraphic in that it has six phonemes (/a, s, z, G, h and t/) that can be represented by more than one grapheme (e.g., graphemes: ث ,س and ص correspond with the phoneme /s/) but it is not polyphonic with more direct (one-to-one) phoneme-grapheme correspondences – and it is considered highly transparent when fully vowelized (Khanlari, 1979; Mahootian, 1997) (see Chapter 3 for a review). Similarly, there are only a limited number of research publications looking at word reading of Persian and even fewer focusing on reading comprehension.

This thesis intends to examine the levels of contribution of underlying cognitive-linguistic skills to Persian reading comprehension. The aim of this work is to develop a model of Persian reading, which also should further inform universal theories of reading. The underlying skills considered for investigation in this thesis as discussed in this chapter are: language related skills, phonological/decoding skills, orthographic skills and speed of

processing as potential predictors of reading comprehension. The studies in this thesis are designed as cross-sectional, recruiting children from Persian Grade 2 to 5 (Grade 2 is the first year children are exposed to the non-vowelized form of the orthography, therefore they are assumed to be inexperienced readers while Grade 5 children can be considered as relatively experienced readers). The concern here was not with between-group comparisons, but with investigation into the relative contribution of several theoretically relevant underlying cognitive skills and abilities to the prediction of text comprehension skills in relatively representative Persian-speaking populations. In addition, this research aims to investigate the relative amount of reading comprehension variance explained by each one of the mentioned cognitive skills (i.e., language skills, phonological skills, orthographic skills and speed of processing) and intends to observe how these levels of explanation might vary across grades.

Chapter 3

The Persian Language and Orthography

3.1 Introduction

This chapter aims to describe the language and writing context in which the research was undertaken. The study included children who were monolingual Persian speakers or Persian-English bilingual speakers, and the focus of the research was to develop a model for reading comprehension for Persian language and compare it with English models in the literature. Therefore, this chapter provides background information about the Persian language and its writing system which is relatively transparent when vowelized. Non-vowelized form of the Persian orthography is also categorized as transparent and complex; transparent because words that have only long vowels can benefit from the written vowels which are included in the orthography, however, this is not the case for words with short vowels (as will be discussed in this chapter). Thus, absence of the short vowels produces many homographs in the non-vowelized form of the orthography whose correct pronunciation should be inferred through context support. This feature of the orthography has made researchers to call this orthography a mixed orthography (Rahbari & Sénéchal, 2009).

3.2 The Persian language

Persian, also known as Farsi (the Arabic equivalent for Parsi, i.e. 'Persian', derived from the name of a historically important region of Iran), is the most widely spoken member of the Iranian branch of the Indo-Iranian languages, a subfamily of the Indo-European languages (Comrie, 1990; Levy, 1951; Mahootian, 1997). Persian was historically a more widely understood language in an area ranging from the Middle East to India. But now it is the

language of Iran (formerly Persia) and is also widely spoken in Afghanistan in an archaic form (Dari), in Tajikistan and the Pamir Mountain region. It also has significant populations of speakers in other Persian Gulf countries (Bahrain, Iraq, Oman, People's Democratic Republic of Yemen, Kuwait and the United Arab Emirates), as well as large immigrant communities in other countries including the USA, UK, Australia and New Zealand.

Persian has been in existence since the 6th century B.C. as a standard and well-recognized language – despite being an acquired second language for some people – of educated men and women in Iran (Levy, 1951). Modern Persian traces to Old Persian, the language of the famous Achaemenid King Darius and Xerxes in the 6th and 5th centuries B.C. Early Modern Persian inherited both its writing system and a large number of vocabularies from Arabic. Persian, similar to English, which retains a heavy lexical debt to French, still hosts thousands of commonly used words of Arabic origin (Mahootian, 1997).

Persian phonemes are grouped into consonants and vowels. Modern Tehrani Persian (where the data for Study 1 was collected) has 23 consonantal and seven vocalic phonemes. Persian vowels are typically classified into six monothongs and one diphthong. In fact, there is some disagreement regarding the number of diphthongs in Persian with the phonemic status of the diphthongs /ow/ and /ej/ being questioned (see Mahootian, 1997, for a review). Mahootian (1997) claims that /ow/ and /ej/ fall within the phoneme boundaries (allophones) of /o/ and /e/ respectively, when occurring at the end of a word or before a consonant. She argues that /j/ has an independent status in Persian since it occurs as a clear consonant sound in initial position (e.g., یک/jek/ meaning one). Hence, /ej/ is two adjacent sounds (i.e., /e/ and /j/) rather than a diphthong because each of the sounds can appear at the beginning or end position individually (note the difference between کی/kej/ meaning what time?, که /ke/ meaning that as a relative pronoun, and کی/ki/ meaning who?). However, the same phoneme cluster in English

is recognised as the diphthong /eI/. Therefore, Persian vowel sounds may be classified as three long vowels (which are represented by alphabet characters), three short vowels and two or three diphthongs. The vowel system in Persian is thus less complex than English with a lower number of sounds to be represented within its orthography.

Appendix A is an index for Persian consonants according to the place and manner of articulation and Appendix B for Persian vocalic phonemes with their transcriptions in the International Phonetic Alphabet (IPA).

3.2.1 Syllable types

There are six syllable types in Persian. Syllables are structured as (C)V(C)(C), where C stands for Consonant and V stands for Vowel. Combination of these syllable types into words of more than one syllable is also evident in Persian (see Table 3.1 for examples) (Mahootian, 1997). In Persian, unlike English, there are no tri-consonant clusters (e.g., straight /streIt/, splash /splæʃ/ and ramps /ræmps/) and bi-consonant clusters appear in final, rather than initial, position alone.

Table 3.1. Persian syllable structure

syllable types			combination of syllable types		
1	V	او/u/ (she, he)	1	(V+CVC)	آتش/atæʃ/ (fire)
2	VC	آب/ab/ (water)	2	(CVC+CVC)	دندان/dændan/ (tooth)
3	VCC	اسب/æsb/ (horse)	3	(VC+CV+CV)	آلبالو/albalu/ (cherry)
4	CV	بو/bu/ (smell)	4	(VC+CVC)	ارزان/ærzan/ (cheap)
5	CVC	پول/pul/ (money)			
6	CVCC	زنگ/zæng/ (bell)			

Note. V=Vowel, C=Consonant

3.2.2 Stress pattern

Word-stress placement/pattern is generally predictable falling on the last syllable with nouns and adjectives, whether long or short; hence in words باهوش/baˈhuʃ/ (clever), or بهترین/behtæˈrin/ (best) stress is on their last syllables. Affixed pronouns do not take the stress, e.g., مادرم/ˈmadæræm/ (my mother). With verbs, the accent shifts according to tense, mood, and sometimes person (Comrie, 1990; Levy, 1951; Mahootian, 1997). Thus in Persian, stress is generally predictable despite the fact that Persian is not a tone language (Mahootian, 1997).

Iranian Persian is pronounced as written when spoken formally. However, colloquial pronunciation, as used by all classes, makes a number of very common substitutions. For

example, نان meaning bread is formally pronounced /nan/ and colloquially /nun/. In addition, Persian has its own characteristic intonation which must be acquired directly in conversation with Persian natives; thus the local vernacular may sound slightly different in various regions (Levy, 1951). These are considered as regional accents which differ in quality of voice, pronunciation of vowels and consonants, stress and prosody (rhythm and intonation). Common substitutions are also evident in the regional accents. Therefore, a Persian accent from different cities sounds quite different. Thus, it was important to utilize the appropriate regional Persian accent to assess the research participants' ability of listening comprehension in this research.

3.3 Persian Orthography

Persian uses a modified version of the Arabic orthography; the script consists of 32 letter characters. It includes 28 Arabic characters plus four additional characters that represent the four phonemes not found in Arabic. These additional characters are: گ /g/, چ /tʃ/, ژ /ʒ/, پ /p/. Table 3.2 presents the alphabet characters used in the Persian orthography with their names and sounds in the International Phonetic Alphabet (IPA).

Table 3.2. The Persian Alphabet Menu

Isolated	Initial	Medial	Final	Symbol	Name
ا، آ	ا، آ	ـا	ـا	/a, æ, e, o/	/ælef/
ب	بـ	ـبـ	ـب	/b/	/be/
پ	پـ	ـپـ	ـپ	/p/	/pe/
ت	تـ	ـتـ	ـت	/t/	/te/
ث	ثـ	ـثـ	ـث	/s/	/se/
ج	جـ	ـجـ	ـج	/j (dʒ)/	/dʒim/
چ	چـ	ـچـ	ـچ	/ c (tʃ)/	/tʃe/
ح	حـ	ـحـ	ـح	/h/	/he/
خ	خـ	ـخـ	ـخ	/X/	/Xe/
د	د	ـد	ـد	/d/	/dal/
ذ	ذ	ـذ	ـذ	/z/	/zal/
ر	ر	ـر	ـر	/r/	/re/
ز	ز	ـز	ـز	/z/	/ze/
ژ	ژ	ـژ	ـژ	/ž (ʒ)/	/ʒe/
س	سـ	ـسـ	ـس	/s/	/sin/
ش	شـ	ـشـ	ـش	/š (ʃ)/	/ʃin/
ص	صـ	ـصـ	ـص	/s/	/sad/
ض	ضـ	ـضـ	ـض	/z/	/zad/
ط	طـ	ـطـ	ـط	/t/	/ta/
ظ	ظـ	ـظـ	ـظ	/z/	/za/
ع	عـ	ـعـ	ـع	/‘ (ʔ)/	/ʔeyn/
غ	غـ	ـغـ	ـغ	/q (G)/	/Geyn/
ف	فـ	ـفـ	ـف	/f/	/fe/
ق	قـ	ـقـ	ـق	/q (G)/	/Gaf/
ک	کـ	ـکـ	ـک	/k/	/kaf/
گ	گـ	ـگـ	ـگ	/g/	/gaf/
ل	لـ	ـلـ	ـل	/l/	/lam/
م	مـ	ـمـ	ـم	/m/	/mim/
ن	نـ	ـنـ	ـن	/n/	/nun/
و	و	ـو	ـو	/v/	/vav/
ه	هـ	ـهـ	ـه	/h/	/he/
ی	یـ	ـیـ	ـی	/y (j)/	/ye/

Note: Adopted from Mahootian (1997), p.4.

Persian script is considered as an alphabetic script and similar to Semitic languages is written from right to left (Khanlari, 1979). Persian is an Indo-European language and not a Semitic language but uses an abjad writing system. The word abjad is derived from the Arabic word for alphabet. Persian orthography like Arabic is cursive; that is, the letters are joined to each other by means of ligatures. Persian letters modify their graphic shape according to their position within a word (i.e., initial, medial, final or isolated) (see Table 3.2 for details). Twenty-five of the conventional 32 letters in the Persian script are two-way connectors (i.e., they join to both preceding and following letters) while the remaining seven letters are one-way connecting letters (i.e., they join to the preceding letters only). Tables 3.3 and 3.4 present the two-way connectors and one-way connecting letters, respectively.

Table 3.3. Persian alphabet characters that are two-way connectors

Two-way alphabet connectors				
ج /dʒ/	ث /s/	ت /t/	پ /p/	ب /b/
ش /ʃ/	س /s/	خ /X/	ح /h/	چ /tʃ/
ع /ʔ/	ظ /z/	ط /t/	ض /z/	ص /s/
گ /g/	ک /k/	ق /G/	ف /f/	غ /G/
ی /j/	ه /h/	ن /n/	م /m/	ل /l/

Table 3.4. Persian alphabet characters that are one-way connectors

One-way alphabet connectors						
و /v/	ژ /ʒ/	ز /z/	ر /r/	ذ /z/	د /d/	ا /a, æ, e, o/

Similar to Arabic (Elbeheri & Everatt, 2007; Elbeheri et al., 2006), the Persian alphabet is phonemic and there are no capital letters in it. There are 17 characters in this script, which with the addition of dots above or below various letters along with two characters, which with or without an additional line placed above the letters, make up the 32 letters of the Persian alphabet. Dots are, therefore, extremely important and differ in their number (one, two, or three) and in their position (below or above the letters). For example, the differences between ب/b/, پ/p/ , ت/t/ , or ث/s/ are both in the number of dots (one in /b/, two in /t/ or three in /p/ and /s/) and their position (above in /t/ and /s/ or below in /b/ and /p/). Similarly, an additional line above ک/k/ makes a different letter گ/g/.

Short vowels in written Persian are not regarded as independent graphemes and are mostly neglected in written texts except the texts aimed at school children in early grades where they appear as diacritic marks. Long vowels, however, are shown by the three consonant alphabet characters (see Table 3.5 for details). In other words, all 32 letters of the alphabet represent consonants, but three of them (i.e., ا, و and ی) have the additional function of indicating that the vowel which accompanies the preceding consonant is to be lengthened in pronunciation. The vowel is usually doubled in length in this case. However, similar to the English orthography, there are plenty of exceptions for character و (Ivey, 1651; Mahootian 1997). This can be exemplified in: خوب /xob/ (good) vs. خوش /xuʃ/ (happy).

There are two more characters in the Persian orthography as ء, called Hamzeh and ّ, called Tashdid which is a marker to show gemination. Hamzeh is sometimes replaced by letter ی /je/ with the same grammatical function. Tashdid is the diacritic mark which represents germination or double stressing of a consonant within word. It is also believed that Tashdid is functionally equivalent to writing a consonant twice in the orthographies of languages like Latin, Italian, Swedish and Ancient Greek (Versteegh, 1997). Syllable classification of words

with Tashdid holds this argument better. When Tashdid appears, the first consonant has no vowel and the second consonant takes the following vowel. For example, بنّا /bænna/ (builder) (note the difference between the word بنّا /bænna/ (builder) and بنا /bæna/ (building) has two syllables: بن/bæn/ and نا/na/ but syllables in the word بنا /bæna/ (building) are: بـ/bæ/ and نا/na/.

Table 3.5. Vowelization in the Persian orthography

Vowel marks				
diacritic marks showing short vowels		َ /æ/ e.g., سَبَد /sæbæd/ (basket)	ِ /e/ e.g., کِتاب /ketab/ (book)	ُ /o/ e.g., کُلاه /kolah/ (hat)
consonant alphabet characters showing long vowels		ا، آ /a/ e.g., ماست /mast/ (yoghurt) e.g., آسمان /aseman/ (sky)	ی، ـی، ـیـ، یـ /i/ e.g., زیبا /ziba/ (beautiful) e.g., آبی /abi/ (blue)	و، ـو /u/ e.g., موش /muʃ/ (mouse) e.g., دور /dur/ (far)

Similar to short vowels, diphthongs (compound vowels) do not have any particular representing characters and the correct pronunciation must be acquired through the auditory system. Examples of the representation of the diphthong /ow/ are: رو /row/ (go), جو /dʒow/ (barley), گود /gowd/ (deep).

As mentioned earlier, long vowels (/i/, /u/, and /a/), are represented by letters in the Persian script, whereas the short vowels and diphthongs (/e/, /u/, /æ/, /ow/, and /eI/) are not typically represented by letters. Short vowels are represented by diacritic marks placed above or below consonant letters (refer to Table 3.5 for examples) but there are no diacritic marks for the

diphthongs. Diphthongs are represented by the letters which also represent the long vowels; therefore, these are totally non-transparent from the start of literacy instruction. In addition, diacritic marks are not always present. At early grade levels, beginning Persian readers are exposed to the texts that are vowelized including short vowel diacritic marks. This form of the orthography is believed to be more transparent by scaffolding decoding processes. The orthography is relatively opaque when short vowel marks are not represented (Arab-Moghaddam & Sénéchal, 2001). The more opaque form of the orthography is mostly used after one year of schooling through a smooth transition. Hence, Persian orthography has both the transparent/shallow and opaque/deep versions.

In terms of spelling, the Persian orthography is more complex due to the correspondence of more than one grapheme to only one phoneme; for example, the phoneme /z/ can be represented by four graphemes: ذ, ز, ض, or ظ (see Table 3.6 for details). Hence, unlike reading, the Persian orthography cannot be considered as a transparent orthography because of its polygraphic characteristics (Arab-Moghaddam & Sénéchal, 2001; Baluch & Danaye-Tousi, 2007; Baluch & Danaye-Tousie, 2006; Rahbari et al., 2007).

Table 3.6. Persian phonemes that correspond to more than one grapheme

Phonemes represented by a number of graphemes					
ا، آ، ع	ت، ط	ث، س، ص	ح، ه	ذ، ز، ض، ظ	ق، غ
/a, æ, o, e/	/t/	/s/	/h/	/z/	/G/

Overall, the specific features of the Persian language suggest that although the orthography is relatively transparent, particularly in the form (vowelized) used with a beginning reader, there

are difficulties for the learner that may lead to differences from those found in English language studies of literacy acquisition and reading difficulties. The initial learning of fully marked text may lead to features of acquisition consistent with relatively transparent orthographies (such as Finnish and German). However, the experience of text that does not contain short vowel marks may lead to similar acquisition features as those found with less transparent orthographies (such as English and French). The additional problems of differences between language and script (i.e., the Persian language using a form of the Arabic script designed for a different language) may lead to additional difficulties for the grapheme-phoneme translation processes and produce findings less consistent with those predicted by studies of transparent orthographies, although research is necessary to determine these potential differences.

3.4 Summary

Persian language, similar to English, is an Indo-European language which utilizes a modified version of the Arabic orthography (Arabic is known as a Semitic language). The Persian language has a simpler sound system compared to English; there are 23 consonants and seven vocalic sounds in the Modern Tehrani Persian, where the current data was collected, while the orthography utilizes 32 alphabet characters (Mahootian, 1997). In addition, the Persian orthography is polygraphic in that it has six phonemes (/a, s, z, G, h and t/) that can be represented by more than one grapheme (e.g., graphemes: ث ,س and ص correspond with the phoneme /s/) but it is not polyphonic with more direct (one-to-one) phoneme-grapheme correspondences – and it is considered highly transparent when fully vowelized (Khanlari, 1979; Mahootian, 1997). Thus, it can be assumed that decoding should not be as demanding

as it is supposed to be in more opaque orthographies, such as English, with more complex sound systems and lesser number of alphabet characters.

The Persian orthography also has two forms: vowelized and non-vowelized. Early readers are exposed to the vowelized form of the orthography which is highly transparent. However, experienced readers are exposed to the non-vowelized form of the orthography. Non-vowelized words in Persian can also be categorized as transparent and complex; transparent because words that have only long vowels can benefit from the written vowels which are included in the orthography, however, this is not the case for words with short vowels. Thus, absence of the short vowels produces many homographs in the non-vowelized form of the orthography whose correct pronunciation should be inferred through context support. This feature of the orthography has made researchers to call this orthography a mixed orthography; words which utilize only long vowels are considered as transparent form of the orthography (e.g., لیوان /li:va:n/ meaning glass), while words with short vowel marks require the reader to infer the vowels (e.g., بسته /bæste/ meaning parcel) – the same is true for words with silent letters (e.g., خواب /kha:b/ meaning sleep, where letter و /vav/ which is also a written long vowel /u:/ is a silent letter) (Rahbari & Sénéchal, 2009).

In addition, the form of Persian used in written text may not be the same as that spoken in every-day conversation by an individual. For example, the Persian accent varies across regions in Iran and, although it is the language of education in regions such as Kurdistan, Lorestan and Azerbaijan, Persian is not the home language. The written form used in all these areas, however, is based on a standard form of Persian. In addition, the spoken form of the language has a lot of substitutions (e.g., میدان /meidan/ in colloquial spoken form is substituted with /meidun/ or بروم /berævæm/ becomes /beræm/). Such forms of diglossia may

lead to the influence of phonological processing differing in literacy development compared to other contexts where written and spoken languages are based on identical sound forms.

Chapter 4

Developing Measures

4.1 Introduction

An assessment battery comprising 19 subtests was developed to investigate predictors of Persian reading comprehension based on pilot work and previous research conducted in English, Arabic and Persian languages (as discussed in previous chapters). Appropriate use of language and context was maintained by setting school text books from grades 1 to 5 primary school and grade 1 intermediate school as the guideline with the selected passages which were modified versions of prose taken from teacher-made comprehension tests from schools separate from those where the tests were piloted and the data was collected. All schools in Iran, regardless of their geographical location and ranking bands, use the same curriculum, with textbooks being exactly the same across schools. The tests were peer reviewed by five primary school teachers and one children's author in Iran to ensure the test materials were appropriate for children from grade 2 to 5 participating in this study.

Tests within the battery measured reading comprehension levels, language related skills, phonological/decoding skills, orthographic skills and speed of processing at elementary level (grade 2 to 5) in Persian language. Table 4.1 presents the tests of the assessment battery.

Table 4.1. An index of subtests of the assessment battery

Reading Comprehension	Cloze
	Questions
Verbal Skills	Listening Comprehension
	Vocabulary
Phonological/Decoding Skills	Sound Deletion
	Sound Segmentation
	Non-word Reading
Orthographic Skills	Matching Words
	Matching Non-words
	Matching Pseudohomophones
	Word Chains 1
	Word Chains 2
	Word Chains 3
	Word Chains 4
	Orthographic Choice
Speed of Processing	RAN Letters
	RAN Words
	RAN Objects
	RAN Colour

The present chapter describes the development of the basic test materials with modifications described in the following chapters. The aim of this chapter is to provide the reader with some background to the materials used and a quick point of reference for measures discussed in later sections of the thesis. The full assessment battery can be found in appendix C.

4.2 Piloting

The measures were piloted with bilingual Persian-English children (N=61) in Christchurch, New Zealand, along with monolingual Persian children (N=46) in Tehran, Iran. The Persian-English bilingual children who participated in the pilot study received one weekly two-hour lesson on Persian literacy using the same course books from Iranian schools. Each Iranian school year takes two years time for these bilingual children (who also attend the mainstream New Zealand schools) to complete. English was recognized as the dominant language for these children based on observation and teachers/parents' interviews. As these children were Afghan nationals, their Persian accent was different from the usual Tehrani vernacular where the data was collected. Therefore, the oral tests were adapted with the norm accent used by these children (i.e., Afghani Persian accent) utilizing their common words to reduce ambiguity. The children at the lower end of Grade 1 were tested along with all children available (Grade 2, 3 and 5). Monolingual Persian children (Grade 2 to 5) were selected from a private school from the Education Organization District 1 (indicating high middle class socioeconomic status) in Tehran, Iran (see Table 4.2 and 4.3 for demographic details).

Table 4.2. Demographics – Number of bilingual Persian – English participants, range and mean age in months per grade

		school grade of child				
		1	2	3	5	Total
Sex of child	male	11	10	7	7	35
	female	12	8	4	2	26
Age in months	mean	130	143	152	179	143
	range	(84-180)	(117-172)	(117-171)	(163-204)	(84-204)

Table 4.3. Demographics – Number of monolingual Persian participants, range and mean age in months per grade

		school grade of child				
		2	3	4	5	Total
Sex of child	male	0	0	0	0	0
	female	8	10	22	6	46
Age in months	mean	95	102	117	129	112
	range	(93-96)	(99-106)	(112-123)	(127-131)	(93-131)

The pilot study on bilingual children (Grade 1, 2, 3 and 5) was a brief trial of test materials and administration. Analyses on the measures suggested the measures to have meaningful correlation. Considering the fact that English was the dominant language for these children, the measures were piloted on monolingual Persian speakers (Grade 2 – 5) as well. Once more, the measures suggested to have meaningful relationships and the range of the scores in each grade (Grade 2 – 5) was satisfactory but we had to reduce the timing for reading comprehension measures, matching measures and word chains measures due to the ceiling effect. Monolingual participants required less time to perform on these measures. Therefore, timing for the text comprehension measures reduced to 10 minutes for the Cloze measure and 15 minutes for the Comprehension Questions. In addition, timing for matching tasks and word chains tasks were reduced to one minute to eliminate ceiling effects.

4.3 General procedures

Tests were administered in two sessions: one individual and one group. Children were tested individually in a quiet room away from distractions within their schools by trained research

assistants who had the experience of teaching young children a foreign language. All research assistants were provided full training prior to testing. Record sheets were used to code answers and 30 percent of the oral tests were recorded. Group testing occurred in a classroom setting, but children were not allowed to talk or see each other's work during the test. Practice trials were included prior to administration of each test to ensure that the child understood the task requirement. Each test session took approximately 50 minutes including short breaks and the full testing procedure performed over several days to avoid fatigue. The measures were presented to the children in the order that the concept in one test should allow understanding in a subsequent task.

In the individual testing session, the participants were given the measures of the Sound Segmentation, Sound Deletion, Non-word Reading, RAN Letters, RAN Words, RAN Objects, RAN Colours, Vocabulary and in the group testing session, they were given the measures of the Listening Comprehension, Reading Comprehension Cloze procedure, Reading Comprehension Questions, Matching Words, Matching Non-words, Matching Pseudohomophones, Orthographic Choice, Word Chains 1, 2, 3, and 4.

4.4 Assessment battery

4.4.1 Reading comprehension

To measure Persian text comprehension, two measures were developed: (i) the Comprehension Cloze and (ii) the Comprehension Questions with unseen passages. Passage length and grade level (i.e., complexity) increased throughout the test. The beginning passage appeared in a larger font size suitable for lower graders.

I. Reading Comprehension Cloze

The Reading Comprehension Cloze measure contained six passages with 26 missing key words. The task required the participants to read the passages quietly and fill in the gaps with the appropriate words selected from a list of key words (including distracter items) presented at the beginning of each passage. There was no time limit for grade 5 participants to do the test and whatever time they spent on this task (they spent 10 minutes) was used as the time limit for the lower graders to avoid fatigue and distraction. Test sheets were collected after ten minutes and the number of the correct responses out of 26 was recorded as the score for this task. Participants were not penalized for misspelling as the aim of the test was to measure text comprehension levels. An example of the reading comprehension cloze measure in Persian with translation in English is presented below.

Persian:

اسکی فوتبال کفش ورزشی راکت

امین و سعید هر دو .....را دوست دارند. آنها هر هفته به یک سالن ورزشی می روند و با سایر دوستانشان بازی می کنند. آنها برای این ورزش نیاز به توپ و ..... دارند.

English Translation:

skiing football sneakers rackets

Amin and Saeid both like ..... . They go to the pitch to play with their friends every week. They need a ball and ..... to play this sport.

II. Reading Comprehension Questions

The Reading Comprehension Questions measure contained six passages and 23 multiple-choice questions. The task required the child to read each passage quietly and answer three to four multiple-choice questions which included three distracters and one correct response. The questions were in form of either referential or inferential. Similar to the Comprehension Cloze measure, there was no time limit for grade 5 participants to do the test and whatever time they spent on this task (they spent 15 minutes) was determined as the time limit for the lower graders to avoid fatigue. Hence, participants had limited time to read and answer the questions (i.e., 15 minutes) but they had unlimited access to the text while answering the comprehension questions. Test sheets were collected after 15 minutes and the number of true responses out of 23 was used as the score for this test (see below for an example of the measure in Persian with English translation).

Persian:

من و خواهرم یک آکواریوم با سه ماهی قرمز زیبا داریم. ما از مادر خواستیم تا برایمان چند ماهی سیاه بخرد. او نیز برایمان دو ماهی خرید. ماهی ها در منزل جدیدشان شاد به نظر می رسند. من و خواهرم هر دو به نوبت آب آکواریم را عوض می کنیم و به ماهی ها غذا می دهیم.

1. ماهی هایی که مادر خرید، چه رنگی بودند؟

الف) قرمز ب) سفید و سیاه ج) سفید د) سیاه

2. بهترین عنوان برای متن فوق چیست؟

الف) من و خواهرم ب) ماهی قرمز ج) آکواریم ما د) خرید ماهی

English:

My sister and I have an aquarium with three beautiful gold fish. We asked mom to buy us a couple of black fish. Mom bought us two more. The fish seem happy in their new home. My sister and I refresh the tank’s water and feed the fish in turns.

1. What colour were the new fish?

a. gray b. gold c. white d. Black

2. Choose the best title for the passage.

a. My Sister and I b. Gold Fish
b. Our Aquarium d. Buying Fish

4.4.2 Language related skills

It is believed that there was no recognized standardized test of verbal ability available in the Persian language (Rahbari & Sénéchal, 2008; Tehrani, 2007). The only published assessment battery found in Persian was the Reading & Dyslexia Test (Kormi-Nouri & Moradi, 2008). However, there was no purely receptive tests of verbal skills (listening comprehension and vocabulary test) included. The listening comprehension measure is the combination of text reading and listening comprehension where participants are required to read texts and listen to them simultaneously and then answer comprehension questions. Considering the differences between the written and spoken form of the Persian language, we decided to develop the Listening Comprehension measure to assess oral language skills. The vocabulary measure was not purely receptive either; the vocabulary subtest of this battery comprises 30 trials of definition, synonyms, word categories and sentence completion (combination of both receptive and productive vocabulary knowledge). Therefore, a vocabulary test which could measure receptive vocabulary knowledge of the research participants seemed more desirable.

To assess language ability in this study, measures of the Listening Comprehension and Vocabulary were developed. The vocabulary subtest of the Reading & Dyslexia Test (RDT Vocabulary) was also used and correlated with our developed vocabulary measure. The RDT Vocabulary test comprises of 30 multiple-choice questions of definitions, use of words and

prototypes where the testee can both read the trials and listen to the examiners read them out loud. Therefore it is assumed that this test dons not assess only receptive vocabulary knowledge.

I. Listening Comprehension

The Listening Comprehension measure contained six passages with the total number of 40 questions. Each passage was followed by several yes/no questions. Length and grade level of the passages increased throughout the test. The spoken rather than written form of the Persian language (which includes some pronunciation changes) was used in the assessment to reflect the oral nature of the task. For example the word دندان /dænda:n/, meaning tooth was uttered /dændu:n/.

The test required the children to listen to six stories followed by several comprehension questions. Referential and inferential comprehension questions were used to measure the participant's understanding of the passages. Length and grade level of the passages increased throughout the test. The child did not see the written form of the passages. Once each passage was articulated, the participants were asked questions about the content. The participants were required to tick their yes/no answers on the provided boxes on their answer sheets for the ease of group administration. Answer sheets were collected after the test and the number of the correct responses out of 40 was used as the score for this task after the participants left the room (see below for an example in Persian with translation in English).

Persian:

بادبادک

رضا یه بادبادک ساخت. علی هم می خواست یکی مث اونو دُرُس کنه. رضا به علی یاد داد که چطوری یه بادبادک بسازه. وقتی کار ساختن بادبادکا تموم شد، اونا هر دو به ساحل رفتن تا بادبارکارو به پرواز در بیارن.

1. آیا حسن یه بادبادک دُرُس کرد؟

2. آیا رضا به حسن یاد داد که چطور بادبادکشو بسازه؟

3.آیا اونا بادبادک هاشونو تو حیاط خانه به پرواز در آوردن؟

English Translation:

Kite

Reza made a kite. Ali wanted to make a similar kite, too. Reza taught Ali how to make a kite. When they made their kites, they went to the beach to fly them.

1. Did Ali make a kite?
2. Did Reza teach Ali how to make a kite?
3. Did they fly their kites in the yard?

II. Receptive Vocabulary

It is assumed that there is no objective word-frequency norm in Persian (Rahbari & Sénéchal, 2008). Hence to develop the receptive Vocabulary measure, curricular sampling (c.f., Fuches

et al., 2008) and social validity approaches (e.g., Gresham, 2002) were utilized by developing a list of words as follows:

1. Ten highly experienced primary school teachers were asked to provide a list of 50 common words for grades 1-5.
2. A list of words from the primary and intermediate school reading books (Primary grade 1-5 and Intermediate grade 1) was extracted. The textbooks in Iran are designed by the Curriculum Development Panel, Ministry of Education, and are taught throughout the educational year across the country. Each reading lesson entails a list of new vocabulary items which was used as the main resource to develop a list of words for the Vocabulary measure.
3. The two lists were compared and the most common words were selected.
4. The list of words was peer reviewed by 10 experienced primary school teachers.
5. Lastly, a list of vocabulary comprising 100 items was finalized and used to develop the Vocabulary measure which was used to assess the receptive vocabulary knowledge of the participants in this study.

The Vocabulary measure containing 100 words (58 nouns, 22 verbs and 20 adjectives) was used to assess the participant's receptive vocabulary knowledge. The assessment was modelled on the Peabody Picture Vocabulary Test, Fourth Edition (PPVT-4: Dunn & Dunn, 2007). The task required the child to select one of four pictures that corresponded with a particular vocabulary item (see Figure 4.1 for an example). The number of the correct responses out of 100 was calculated and used as the score for this task.

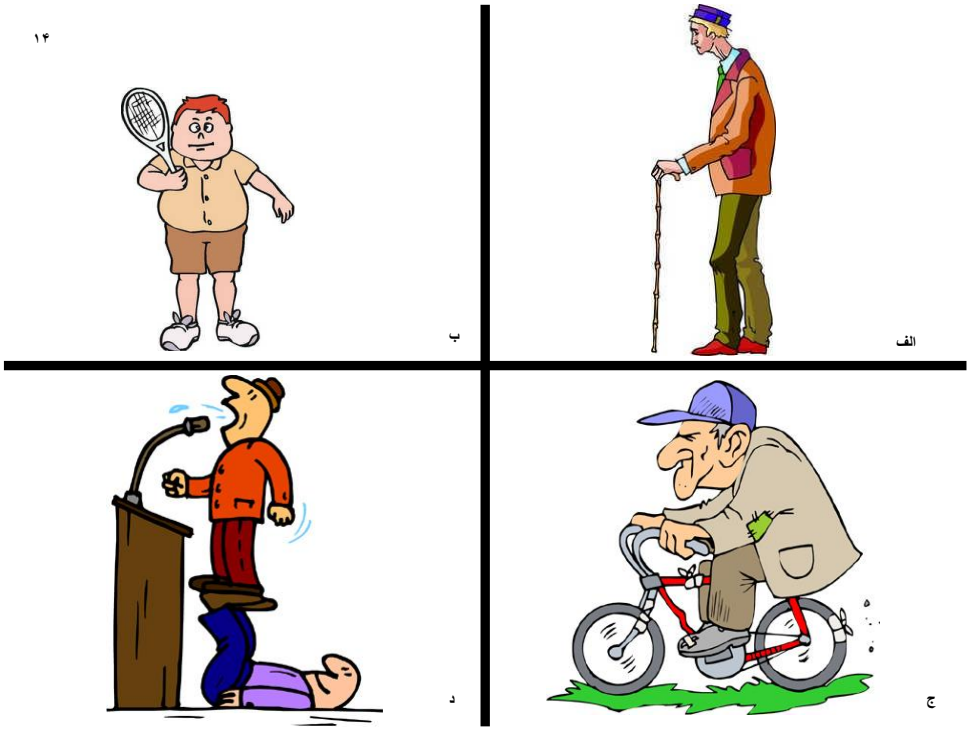

Figure 4.1. An example of the Vocabulary Measure – the target word is: 'TALL'

4.4.3 Phonological/Decoding skills

To measure phonological/decoding skills, measures of the Sound Deletion, Sound Segmentation and Non-word Reading were modelled on those reported in English (e.g., Woodcock, McGrew, & Mather, 2001). These measures will be briefly described below.

I. Sound Deletion

The Sound Deletion measure was developed to assess the child's ability to recognize sounds within words. This task required the child to say a word without one of its basic sounds (e.g.,كتاب /keta:b/ meaning book without /ب b/ - the expected answer is كتا /keta:/). Fifteen items were developed which varied in their level of difficulty by increasing the number of the phonemes per word from those with five phonemes to words consisting of nine phonemes.

Phonemes were deleted from the initial, medial or final positions (5 trials each). The number of the correct responses out of 15 was used as the score for this task.

II. Sound Segmentation

The Sound Segmentation measure was developed to assess the child's ability to recognize sounds within a word. In this task, the child was presented verbally with a word and was asked to segment it into the component phonemes. For example, the wordمسواک /mesva:k/, meaning toothbrush, was presented to the child and they were required to recognize each individual phonemes: i.e., /م m/, /ِ e/, /س s/, /و v/, /ا a:/, and /ک k/. The child could earn one score for recognizing all the phonemes of the given word correctly (Tehrani, 2007). Complexity of the stimuli increased throughout the test by increasing the number of the phonemes per word from those with three phonemes to words consisting of nine phonemes. There were fifteen items in this measure and the number of the correct responses out of 15 was used as the score for this task.

III. Non- word Reading

Non-word reading was used as a measure of the ability to translate letter strings into an appropriate pronunciation (i.e., decoding), which can be considered as a basic literacy skill or as indicative of phonological translation process (Dollaghan & Campbell, 1998). The Non-word Reading task required the child to read 30 non-words using letter-sound conversion rules without accessing a word lexical entry. Non-words were derived from real Persian words by rearranging or replacing letters to ensure that they were word-like. Since the short vowels in Persian orthography are not marked for experienced readers (i.e., from grade 2), all acceptable pronunciations (e.g. موک /mu:k/ or /muk/) were considered as correct responses. The trials were classified into three groups of non-words with one, two, and three and more

syllables (see Table 4. 4 for examples in English and Persian) and they appeared on one page (A4 card). As Persian is written from right to left, the child was required to read the items on the same direction (i.e., from top right hand side to the bottom left side of the page). A stopwatch was used to record the time each individual spent on this task. Participants were told that they were given some made-up words and they should try to pronounce them accurately and clearly for the assessor. The number of the correctly pronounced items out of 30 along with the time in seconds was used for this measure.

Table 4.4. Examples of Non-words in Persian

سه سیلابی Three- and more-syllable	دو سیلابی Two-syllable	یک سیلابی One-syllable
ابتکاس (مانند ابتکار) caravap (as in caravan)	بارات (مانند باران) bupper (as in butter)	صیز (مانند میز) gat (as in cat)

4.4.4 Orthographic skills

Orthographic skills were assessed by the Matching, Word Chains and Orthographic Choice tasks. Development of the measures is briefly explained below.

I. Matching tasks

Three forms of the Matching tasks: Matching Words, Matching Non-words and Matching Pseudohomophones were developed to assess the child's orthographic skills and knowledge of the letters in Persian. These tasks required the child to recognize as many as the matched pairs. The tasks were timed and answer sheets for each task were collected after one minute.

The number of the correct responses out of 25 was recorded after the child left the room and was used as the score for each task.

a. Matching Words

In this measure, the child was tested on their ability to recognize whether two words presented side by side were the same. Fifty trials of paired words presented to the child. For instance, the word بنا /bæna:/, meaning building, and the word بيا /bIa:/, meaning come, look relatively similar; both consist of three letters and are written similarly but they are different in the letter appeared in the middle (i.e., ـنـ/n/ in /bæna:/ and ـيـ/I/ in /bIa:/). The child was required to underline the matched pairs in one minute. The number of the correct responses out of 25 was the score for this task.

b. Matching Non-words

Similar to the Matching Word task, 50 trials of non-words were developed to assess the child's orthographic skills preventing them from accessing a word lexical entry. Participants were told that they were given some made-up words and they should try to underline the matched pairs in one minute. The number of the correct responses out of 25 was the score for this task.

c. Matching Pseudohomophones

Since it is hypothesized that both the Matching Words and Non-words measures may be processed through knowledge of sound or (sound discrimination), the Matching Pseudohomophones measure was developed to look into orthographic skills per se. This measure contained 50 trials of non-words which sounded exactly the same. Half of the items were the same and the other half were different in one letter using homophones (e.g., س & ص

/s/). For instance, the two different non-words لاسر and لاصر sound the same /la:sə(r)/. Participants were told that they were given some made-up words and they should try to underline the matched pairs in one minute. The number of the correct responses out of 25 was the score for this task.

II. Word Chains Tasks

Four types of the Word Chains tasks were developed to measure the child's orthographic skills. These tasks were used to assess the child's ability to recognize word boundaries.

Persian orthography is a cursive writing. Letter shapes vary depending on their positioning at the beginning, middle, or end of a word. In addition, some of the letters are one-way connectors or they never connect to their previous and preceding letter (see Table 4.5 and 4.6 for examples). Hence the Word Chains 1 and 2 utilized words in a letter string by reducing the word boundaries without changing the shape of the letters while the Word Chains 3 and 4 utilized words in a letter string connecting all the letters to each other changing their shapes when necessary.

Table 4.5. Examples of how Persian letter shapes vary depending on their positioning

Full Form	Final	Medial	Initial
ن /n/	ـن /n/	ـنـ /n/	نـ /n/
جوان	آهن	صندلی	نیاز
(young)	(iron)	(chair)	(need)

Table 4.6. One-way connector Persian letters

Full Form	و /v/	ژ /ʒ/	ز /z/	ر /r/	ذ /z/	د /d/	ا /a:/
Connected Form	ـو	ـژ	ـز	ـر	ـذ	ـد	ـا
Examples	مورچه (ant)	مژده (good news)	تلویزیون (television)	ابرو (eyebrow)	لذت (joy)	زندان (prison)	بام (roof)

a. Word Chains 1 (Random words - letters not changed)

This task was used as a measure of the ability to recognize word boundaries in a string of words (i.e., the space between the words was eliminated). Shapes of the letters were not changed when connecting to the previous and preceding letters. The task contained ten sets of 50 randomly selected words and required the child to recognize each word and apparently the word boundaries by drawing a line at the end of each word. The test was timed and participants were asked to stop after one minute. The number of the correctly recognized words out of 50 was used as the score for this task (see below for an example in Persian with English translation).

Persian:

قصدهدف بارابرایران

قصد/هدف/بار/ابر/ایران

English translation:

intentiontargetloadcloudiran

intention/target/load/cloud/iran

b. Word Chains 2 (sentences – letters not changed)

Similar to the Chain Words 1, this task required the participants to recognize the word boundaries in a string of words (i.e., the space between the words was eliminated). Shapes of the letters were not changed when connecting to the previous and preceding letters.. Seven sentence trials containing the total number of 52 words were developed to provide the child with a meaningful context. Since it was a timed test, the participants were asked to stop after one minute and the number of the words they recognized correctly out of 52 was used as the score for this task (see below for an example in Persian with English translation).

Persian:

دیروزهواابری بود.

دیروز/هوا/ابری/بود.

English translation:

Itwascloudyyesterday.

It/was/cloudy/yesterday.

c. Word Chains 3 (random words – letters changed)

The Word Chains 3 was developed to assess the child's orthographic skills (word boundary) similar to the Word Chains 1 and 2. In this task, in addition to the elimination of the space between the words, the shapes of the letters got changed when connecting to the previous and preceding letters. The task required the child to recognize the words within each string set and draw a line to indicate the word boundary. The test was timed and participants were asked to stop after one minute. The number of the correctly recognized words out of 50 was used as the score for this task (see below for an example in Persian with English translation).

Persian:

قصهمنگاهیمیخوانم

قصه/من/گاهی/میخوانم

English translation:

storyisometimesread

story/i/sometimes/read

d. Word Chains 4 (sentences – letters changed)

The Word Chains 4 was very similar to the Word Chains 3. This task contained five trials of meaningful phrases and/or sentences. All letters connected to one another changing their shapes to form the five trials of letter strings. Similar to the Word Chains 3, this task required the child to recognize the words within the letter strings. This task was also timed and the students were asked to stop after one minute. The number of the correctly recognized words out of 51 was the measure for this task (see below for an example in Persian with English translation).

Persian:

منعلیرادیدم.

منـ/ـعلیـ/ر ا/دیدم.

English translation:

isawali.

i/saw/ali.

III. Orthographic Choice

The Orthographic choice task modelled on those by Olson, Wise, Conners, Rack, & Fulker (1989) was used to assess the child's ability to recognize the correct spelling form of a word. Thirty trials of words paired with non-word homophones were developed. For example the word مدرسه/mædreseh/, meaning school, was paired with the non-word homophone مدرثه. The task required the child to distinguish the correct spelling form within each pair by drawing a line under the correct spelling of the word. The task was timed and the child was asked to stop after one minute. The number of correct responses out of 30 was the score for this task (see below for examples in English and Persian).

Persian:

عاشورا آشورا

English:

munk monk

4.4.5 Speed of processing

The ability to accurately and quickly access a phonological form was assessed by four Rapid Automatic Naming (RAN) tasks: RAN Letters, Words, Objects and Colours. These tasks were used to measure the speed at which the child processed information from their lexicon and were derived from similar measures in the literature (e.g., Denckla & Rudel, 1976; Wolf et al., 1986). The first two tasks (i.e., RAN Letters and Words) were used to measure the speed at which the child could access to phonological representation of the letters and words (i.e., decoding speed) and the other two (i.e., RAN of Objects and Colours) were used to measure the speed of general cognitive processing of the child.

The measures for speed of processing required the child to name all the items (i.e., 36 letters, 35 words, 36 drawings, and 32 colours) on an A4 card from right to left (similar to the direction of Persian writing system), as quickly as possible, trying to avoid naming errors. Prior to speeded testing, the participants' ability to name the items was checked. A stop watch was used and the time the child took to name all the items was recorded in seconds, along with any naming errors. Given the small number of naming errors, the time was used as the sole measure for this task. Each measure is briefly described.

I. RAN Letters

The RAN Letters task was used to measure the speed at which the child named/sounded familiar alphabet letters. For example, letter ل is named لام/la:m/ and makes the sound /l/; either of these (character's name or its sound) was considered as a correct response. The child was presented with a chart containing 36 familiar letters in Persian in four lines (three repetitions of 12 different alphabet characters) for this task (see Table 4.7 for the Persian letters used in this task with English equivalents in brackets).

Table 4.7. Trials used in RAN Letters with English equivalents in brackets

ک	ز	م	ی	ل	ن
(k)	(z)	(m)	(y)	(l)	(n)
س	ط	ع	پ	ب	و
(s)	(t)	(a)	(p)	(b)	(v)

II. RAN Words

The RAN Words task was used to assess the child's naming speed. This task was used to measure the speed at which the child read familiar words in Persian. The child was presented with a chart containing 32 familiar two to three syllabic words in eight lines for this task (see Table 4.8 for the Persian words used in this task with English translations in brackets).

Table 4.8. Trials used in RAN Words with English translations in brackets

مدرسه (school)	اتوبوس (bus)	لباس (dress)	نان (bread)
خودنویس (fountain pen)	تعطیلات (holiday)	مهندس (engineer)	بازی (game)

III. RAN Objects

The RAN Objects task was developed to assess the child's naming speed. This task was used to measure the speed at which the child named drawings of familiar objects. The child was presented with a chart containing 36 pictures/drawings of familiar objects in four lines (three repetitions of 12 different drawings) for this task (see Figure 4.2 for the pictures/drawings used in this task).

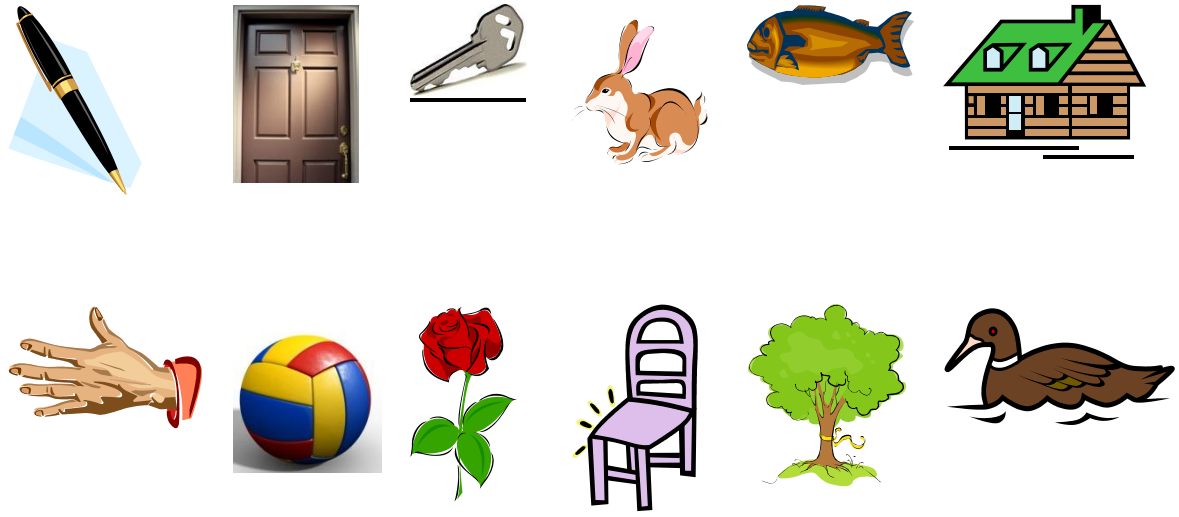

Figure 4.2. Pictures/drawings used in the RAN Objects

IV. RAN Colours

The RAN Colours task was used to assess the child's naming speeds. This task was used to measure the speed at which the child named drawings of familiar colours. The child was presented with a chart containing 32 pictures/drawings of familiar colours in four lines (eight repetitions of four different colours) for this task (see Figure 4.3 for the colours used in this task).

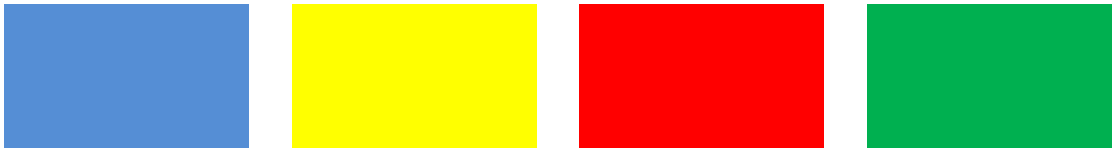

Figure 4.3. Colours used in the RAN Colours

Chapter 5

Study 1

Models of Reading Comprehension

Investigations into Persian Monolingual Speakers

5.1 Introduction

Despite evidence that reading processes depend on the language of the reader and the writing system that encodes that language (Perfetti, 2001), most of the reading models/interpretations on reading processes have been derived from studies of English. Although relationships between underlying cognitive skills and literacy learning have been found across a number of languages, there is still a need for investigating these skills in other orthographies to test current theories or reading models universally. In fact, one of the reasons for caution here is that children learning a transparent orthography with a more consistent relationship between written symbols (letters/graphemes) and language sounds (phonemes) than that found in English seem to show faster progress in word-level literacy, and process language at the level of the phoneme earlier, than those learning a less regular orthography (Seymour et al., 2003). The view that English is less transparent (i.e., the relation between written form and language sounds is less clear) than most other orthographies has led some to question the universality of current English-language derived theories about literacy learning (Share, 2008). Therefore, research on other languages/orthographies is needed to validate current models of reading.

Additionally, compared to children learning English literacy skills, phonological awareness deficits may create fewer problems when learning a regular orthography since the simple rules or correspondences between letters and sounds will be less tasking for the phonological system (Seymour et al., 2003). Therefore, even if phonological deficits lead to literacy learning problems, these may be less severe when learning a more transparent orthography. As such, the transparency of the script is a factor that may lead to variations between languages in the ease of literacy acquisition, the manifestation of literacy deficits and the appropriateness of particular assessment procedures (Everatt et al., 2010; Everatt et al., 2004). For example, whereas assessments of accuracy in word reading tasks seem appropriate to assess literacy skills in English, such tools may be less effective in more transparent orthographies where decoding seems less laborious and given enough time to use translation processes in decoding usually leads to ceiling effects. As such, literacy assessment procedures may better focus on measuring fluency, or speed of processing.

Persian orthography (as described in Chapter 3) has some interesting features that may lead to skills developing differently from those predicted by current models of reading derived from English. In contrast to English, but similar to Semitic languages (e.g., Arabic), the Persian orthography is written from right to left. The orthography is a modified version of the Arabic orthography, though with more graphemes than Arabic – interestingly, the Persian language has fewer phonemes compared to Arabic, meaning that several graphemes are used to represent the same phoneme. The orthography is cursive, with most letters changing their shape when connecting to letters around them. It also uses combinations of dots and marks within and around basic symbol shapes to distinguish letters/determine pronunciation, as well as to represent syntactic rules and morphological forms. In addition, several such marks are used to represent short vowel sounds and these vowel markers are not always included in

written text, particularly in passages targeted at more experienced readers. This elimination of short vowel markers leads to a reasonably large number of homographic letter strings in written Persian and means that, after first grade, Persian children need to learn to infer short vowel sounds from the context within which a word is written in order to obtain literacy learning at an early age for most Persian children.

Additionally, the form of Persian used in written text may not be the same as that spoken in every-day conversation by an individual. For example, the Persian accent varies across regions in Iran and, although it is the language of education in regions such as Kurdistan, Loristan and Azerbaijan, Persian is not the home language. In Iran, Persian is called Farsi, whereas in Afghanistan, it is called Dari and the accent used in the two versions varies. Such forms of diglossia may lead to the influence of phonological processing differing in literacy development compared to other contexts where written and spoken languages are based on identical sound forms.

The current study investigated the underlying cognitive-linguistic skills of Persian reading comprehension in order to develop a Persian reading comprehension model. It also aimed to assess the usefulness of the simple view of reading (SVR) (Gough & Tunmer, 1986; Hoover & Gough, 1990; Tunmer & Chapman, 2012) and/or the component model of reading (CMR) (Joshi and Aaron, 2000) in explaining the acquisition by primary school children of the Persian orthography which, at least in its fully vowelized form, is believed to be relatively transparent. Given these models, the study assessed the contribution of word-level reading and language understanding skills to Persian reading comprehension by identifying predictors of variability in reading comprehension. As argued before, Persian is a language/orthography that has been scarcely studied, particularly in monolingual children, but has characteristics that make the assessment of text processing potentially informative about universal theories

of reading comprehension. Hence, the identification of predictors of variation in Persian reading comprehension should inform further models across languages.

The study assessed predictors of variation in Persian reading comprehension through a cross sectional design which measured skills amongst grade 2 to 5 primary school children attending mainstream schools in Iran. The concern here was not with between-group comparisons, but investigation into the relative contribution of several theoretically relevant abilities (cognitive-linguistic processes) to the prediction of text comprehension skills in a typical group of monolingual learners who were acquiring Persian literacy skills as part of normal mainstream schooling – a method that has been used to inform models of English reading comprehension (e.g., Adlof et al., 2006). Data analyses were used to determine whether the targeted underlying cognitive-linguistic (i.e., verbal skills, phonological skills, orthographic skills and speed of processing) were significant predictors of Persian reading comprehension.

5.2 Methodology

5.2.1 Participants

The study recruited a relatively homogeneous cohort of participants in terms of socioeconomic status so that large variability in reading and language skills due to socioeconomic factors could be avoided. Socioeconomic status was determined according to the Tehran Education Organization District 1 school ranking system. In Tehran, a school ranked ‘Advantaged’ indicates that the degree to which a school obtains its pupils from low socioeconomic areas is very low. Participants were selected from two Iranian single-sex public schools (one for boys and one for girls) ranked ‘Advantaged’ in the northern part of

Tehran (District 1) indicating high middle class socioeconomic status. All schools in Iran, regardless of geographical location and Ranking Bands, use the same curriculum, with textbooks being identical across schools. Two classes from each grade (grade 2 to 5) with approximately 60 children (30 boys and 30 girls) were selected randomly from participating schools, and all children within those classes available at the time of testing were assessed. In all, 232 participants were tested. Roughly, half of these children were male and the other half were female (see Table 5.1). All children were first language Persian speakers (based on teacher interviews, background information about the school population and a questionnaire filled out by parents).

Table 5.1. Demographics – Number of participants, range and mean age in months per grade

School grade of child		2	3	4	5	Total
Sex of child	male	30	32	25	34	121
	female	26	27	31	27	111
Mean age in months		94	107	119	130	113
Range age in months		(89-100)	(101-116)	(110-127)	(124-138)	(89-138)

Data from 199 children was analysed: Table 5.2 presents a brief summary of why certain children were not selected for analysis. Children selected for inclusion in the analyses were all those who performed comprehension measures; hence, any participants who did not perform the comprehension measures due to absenteeism were deselected (N=20). Children scoring more than three standard deviations from the mean in any measures were also deselected (N=9): the rationale being that such outliers may have a disproportionate influence on the analyses. Finally, those children with recognized problems were not included in the

analyses (N=4). These comprised: (i) two children who used hearing aids, one of whom received special lessons after school and was assisted with subjects like science and maths; (ii) one child who had attention problems, according to the classroom teacher, who referred to this child as a low achiever, possibly due to poor attention; and (iii) one child who, during the current testing, was recognized with relatively serious difficulties in articulation.

Table 5.2. Summary on case selection

	Frequency	Percent
Total number of children tested	232	100
Children with no comprehension measures	20	8.6
Outliers in measures	9	3.9
Children with observed difficulties	4	1.7
Cases analysed	199	85.5

Following Educational Research Human Ethics[1] approval and relevant approvals from the Iranian authorities[2&3] to conduct the study, standard procedures, confidentiality of participants and parental permission for entry into the study were followed. Five research assistants with experience of teaching young children were recruited and trained to administer the test materials using the same procedure for each individual. Research assistants were all language teachers with a minimum of two years of experience working with young children.

[1] The University of Canterbury's Educational Research Human Ethics Committee approved the study.

[2] The Tehran Head Office for the Iranian Ministry of Education's Research Committee approved the study.

[3] The Tehran Education Organization District 1 approved the study and introduced the research team to the selected schools.

The research assistants were trained and provided step by step instructions on the administration of the test materials.

5.2.2 Measures

An assessment battery comprising 19 experimental measures and one published test was developed based on pilot work and previous research conducted in English, Arabic and Persian languages. As outlined in Chapter 4, appropriate use of language and context was maintained by using school text books as a guideline for the selection of passages and other written and verbal materials. Tests were peer reviewed by five primary school teachers and one children's author in Iran to ensure the materials were appropriate for children from grades 2 to 5. Tests within the battery were designed to measure reading comprehension levels, language skills, phonological/decoding skills, orthographic skills and speed of processing at elementary level in the Persian language.

Tests were administered in one individual and one group test session. In the former, children were tested individually in a quiet room away from distractions within their schools. Group testing occurred in a classroom setting, but children were not allowed to talk or see each other's work. Practice trials were included prior to administration of each test to ensure that the child understood the task requirement. Each test session took approximately 50 minutes including short breaks, with the full testing procedure being performed over several days to avoid fatigue. Although a number of children did not perform all the measures due to absenteeism, it is unlikely that the students stayed away from school to avoid testing since the days for test administration were not advertised and the participants were not aware of the day they were to perform the measures. More likely is that these children did not attend school due to typical reasons for absenteeism (such as illness).

The order of presentation of measures presented to the children was determined so that a concept in one test should allow understanding in a subsequent task. In the individual testing session, the participants were given the following measures in this order: Vocabulary, Reading and Dyslexia Vocabulary subtest (Koromi-Nouri & Moradi, 2009), Sound Deletion, Sound Segmentation, Non-word Reading, RAN Letters, RAN Words, RAN Objects, and RAN Colours. In the group testing session, they were given the following measures in this order: Reading Comprehension Cloze procedure, Reading Comprehension Passage Questions, Listening Comprehension, Matching Words, Matching Non-words, Matching Pseudohomophones, Orthographic Choice, Word Chains 1, Word Chains 2, Word Chains 3, and Word Chains 4 (see chapter 4 for full details of the test measures). Raw scores were collected for all measures for analysis purposes. Table 5.3 provides an overview of the measures used in this study, with the general area of ability, or skills set, within which they are considered to sit.

Table 5.3. An index of subtests of the assessment battery

Reading Comprehension	Cloze
	Questions
Verbal Skills	Listening Comprehension
	Vocabulary
	RDT Vocabulary
Phonological/Decoding Skills	Sound Deletion
	Sound Segmentation
	Non-word Reading
Orthographic Skills	Matching Words
	Matching Non-words
	Matching Pseudohomophones
	Orthographic Choice
	Word Chains 1
	Word Chains 2
	Word Chains 3
	Word Chains 4
Speed of Processing	RAN Letters
	RAN Words
	RAN Objects
	RAN Colour

Note. RDT Vocabulary=Reading & Dyslexia Test of vocabulary, RAN=Rapid Automatized Naming

5.3 Results

5.3.1 Descriptive statistics and comparisons across grades

Descriptive statistics can be found in Table 5.4 – Table 5.7 with the means and standard deviations for each measure presented for each grade level. Overall, the mean values showed improvements with grade level consistent with increasing age and educational experience, and standard deviation scores indicated reasonable levels of individual variability. However, there were exceptions to these general trends in the descriptive data. The Non-word Reading scores showed little variation due to ceiling effects in this measure. This is often found in a more regular orthography (see Introduction) and is the reason that Non-word Reading fluency (rather than accuracy) scores was computed by divining the number of correctly pronounced items by time in seconds and were used in subsequent analyses. On the other hand, the Sound Segmentation task showed neither growth across grades nor (as later discovered) reasonable correlations with the other phonological measures. This questioned the usefulness of this task in the present work and, hence, this measure was not used in further analyses discussed in this chapter.

Table 5.4. Mean scores and standard deviations for understanding measures (reading comprehension, listening comprehension and vocabulary) produced by grades in the study

		Reading Comprehension		Listening Comp	Vocab	RDT Vocab
		Cloze	Questions			
Total scores		26	23	40	100	30
Grade 2	Mean	8.35	6.04	29.63	69.86	19.76
	SD	3.78	3.12	4.70	8.91	4.02
Grade 3	Mean	12.89	10.84	32.03	70.67	21.64
	SD	5.01	3.89	3.86	8.45	4.07
Grade 4	Mean	16.86	13.51	33.59	76.63	24.06
	SD	4.54	3.47	3.48	5.34	3.34
Grade 5	Mean	18.60	14.80	35.58	81.78	26.18
	SD	5.85	3.54	3.04	6.81	3.10

Note. Listening Comp= listening comprehension, Vocab=vocabulary, SD=standard deviations, Vocab =vocabulary, RDT Vocab=Reading & Dyslexia Test of vocabulary

Table 5.5. Mean scores and standard deviations for measures of phonological skills (non-word reading, sound segmentation, sound deletion) produced by grades in the study

		Non-word reading score	Non-word reading time in second	Non-word reading fluency	Sound segment	Sound deletion
Total scores		30	–	–	15	15
Grade 2	Mean	27.25	71.43	.42	12.65	12.61
	SD	2.30	20.87	.13	2.10	2.49
Grade 3	Mean	28.66	53.77	.58	12.38	13.10
	SD	2.05	16.80	.18	1.99	1.94
Grade 4	Mean	28.18	50.98	.60	12.00	13.63
	SD	1.93	15.71	.18	2.11	1.43
Grade 5	Mean	28.75	43.71	.73	12.31	13.66
	SD	1.84	15.02	.23	2.11	1.97

Note. SD=standard deviations, Sound Segment=sound segmentation

Table 5.6. Mean scores and standard deviations for measures of orthographic skills produced by grades in the study

		Matching			Word Chains				
		words	Non-words	Pseud	1	2	3	4	Ortho Choice
Total scores		25	25	25	50	52	50	51	30
Grade 2	Mean	12.48	8.02	9.26	21.88	34.80	7.68	6.43	13.55
	SD	4.21	3.20	3.42	11.52	10.30	6.20	3.77	5.10
Grade 3	Mean	18.56	12.16	13.06	37.10	42.32	11.02	11.10	16.94
	SD	4.85	4.00	5.16	11.91	7.22	7.77	6.69	6.98
Grade 4	Mean	19.71	13.24	16.51	41.00	45.54	10.16	14.58	25.32
	SD	4.90	5.04	5.30	7.70	5.82	7.08	8.62	5.65
Grade 5	Mean	21.54	15.12	18.45	44.29	42.75	14.36	17.92	26.96
	SD	4.20	3.85	4.87	6.33	9.66	8.05	10.43	4.66

Note. SD=standard deviations, Pseud=Pseudohomophones, Ortho Choice=orthographic choice

Table 5.7. Mean time per second and standard deviations (SD) for measures of speed of processing produced by grades in the study

		Rapid Naming (RAN) (time in seconds)			
		Letters	Words	Objects	Colour
Grade 2	Mean	23.22	29.67	39.03	27.89
	SD	5.90	9.12	10.03	5.76
Grade 3	Mean	22.86	23.70	33.97	25.30
	SD	8.55	9.32	7.05	6.41
Grade 4	Mean	19.93	19.76	32.68	23.83
	SD	5.00	4.99	7.13	4.98
Grade 5	Mean	19.09	18.49	31.53	21.32
	SD	4.09	4.29	5.56	3.84

5.3.2 Correlation amongst the measures

To assess the relationship between the text comprehension measures and the other measures used in this study, first-order correlations and partial correlations controlling for age (in months), sex and grade were calculated. Tables 5.8 – 5.13 present first-order correlations (lower diagonal) and partial correlations between the measures in the study.

Relationships were found between similar measures as predicted. The two text comprehension measures were related, as were the two Vocabulary measures (r=.570, *p*=<.01). Despite the differences in the format of the two vocabulary measures, the correlation between them proved as significant which indicated that the two measures were likely to be similar, thus the vocabulary measure developed as part of the thesis work was used in the analyses for the present study. The three Matching tasks (i.e., Matching Words,

Non-words and Pseudohomophones) were inter-related and correlated with the Orthographic Choice task. However, the Word Chains measures showed mixed relationships with the other measures of orthographic processing. Similarly, speed measures showed variable relationships, with RAN Objects and RAN Colours been reasonably correlated, and these two measures been related to RAN Letters, but RAN Words showing smaller correlations with the other RAN measures once age, sex and grade were controlled.

Table 5.8. First-order correlations between the two reading comprehension measures and all other measures used in the study

	RC Cloze	RC Ques
RC Ques	.736**	
List Comp	.532**	.569**
Voc	.575**	.492**
RDT Voc	.578**	.528**
NW Read	.616**	.581**
Sound Seg	.091	–.004
Sound Del	.380**	.323**
Match W	.572**	.518**
Match NW	.439**	.458**
Match Psd	.529**	.443**
W Chains1	.558**	.553**
W Chains2	.284**	.375**
W Chains3	.484**	.413**
W Chains4	.611**	.456**
Orth Choic	.693**	.682**
RAN Let	–.274**	–.300**
RAN W	–.466**	–.479**
RAN Obj	–.419**	–.403**
RAN Col	–.419**	–.447**

Note. RC Cloze=reading comprehension Cloze, RC Ques=reading comprehension Questions, List Comp=listening comprehension, Voc=vocabulary, RDT Voc=vocabulary subtest of the Reading & Dyslexia Test, NW Read=non-word reading, Sound Seg=sound segmentation, Sound Del=sound deletion, Match W=matching words, Match NW=matching non-words, Match Psd=matching pseudohomophones, W Chains=word chains, Orth Choic=orthographic choice, RAN Let=rapid naming of familiar letters, RAN W=rapid naming of familiar words, RAN Obj=rapid naming of familiar objects, RAN Col=rapid naming of familiar colours

*p < .05. **p <.01.

Table 5.9. Partial correlations (controlling for age month/form, sex and grade) between the two reading comprehension measures and all other measures used in the study

	RC Cloze	RC Ques
RC Ques	.635**	
List Comp	.344**	.337**
Voc	.372**	.243**
RDT Voc	.374**	.235**
NW Read	.468**	.363**
Sound Seg	.201*	.158
Sound Del	.315**	.279**
Match W	.338**	.279**
Match NW	.165	.221**
Match Psd	.309**	.183*
W Chains1	.386**	.320**
W Chains2	.207*	.255**
W Chains3	.381**	.275**
W Chains4	.453**	.348**
Orth Choic	.328**	.404**
RAN Let	–.168	–.124
RAN W	–..226**	–.223**
RAN Obj	–.309**	–.253**
RAN Col	–.267**	–.259*

Note. RC Cloze=reading comprehension Cloze, RC Ques=reading comprehension Questions, List Comp=listening comprehension, Voc=vocabulary, RDT Voc=vocabulary subtest of the Reading & Dyslexia Test, NW Read=non-word reading, Sound Seg=sound segmentation, Sound Del=sound deletion, Match W=matching words, Match NW=matching non-words, Match Psd=matching pseudohomophones, W Chains=word chains, Orth Choic=orthographic choice, RAN Let=rapid naming of familiar letters, RAN W=rapid naming of familiar words, RAN Obj=rapid naming of familiar objects, RAN Col=rapid naming of familiar colours

*p < .05. **p <.01.

Table 5.10. First-order correlations (lower diagonal) and partial correlations (controlling for age month/form, sex and grade) between the linguistic comprehension measures in the study

	RC Cloze	RC Ques	List Comp	Vocab
RC Cloze		.635**	.344**	.372**
RC Ques	.736**		.337**	.243**
List Comp	.532**	.569**		.303**
Voc	.575**	.492**	.513**	

Note. RC Cloze=reading comprehension Cloze, RC Ques=reading comprehension Questions, List Comp=listening comprehension, Voc=vocabulary, RDT Voc=vocabulary subtest of the Reading & Dyslexia Test

*p < .05. **p <.01.

Table 5.11. First-order correlations (lower diagonal) and partial correlations (controlling for age month/form, sex and grade) between the measures of phonological skills in the study

	NW Read	Sound Seg	Sound Del
NW Read		.315**	.382**
Sound Seg	.183*		.330**
Sound Del	.402**	.248**	

Note. NW Read=non-word reading, Sound Seg=sound segmentation, Sound Del=sound deletion

*p < .05. **p <.01.

Table 5.12. First-order correlations (lower diagonal) and partial correlations (controlling for age month/form, sex and grade) between the measures of orthographic skills in the study

	Match W	Match NW	Match Psd	W Chain 1	W Chain 2	W Chain 3	W Chain 4	Orth Choic
Match W		.609**	.485**	.449**	.218*	.137	.347**	.375**
Match NW	.639**		.430**	.281**	.039	.073	.223**	.379**
Match Psd	.638**	.565**		.283**	.224**	.303**	..277**	.264**
W Chains1	.518**	.491**	.523**		.339**	.305**	.339**	.207*
W Chains2	.244**	.215**	.299**	.493**		.151	.180*	.181*
W Chains3	.325**	.179*	.340**	.375**	.213**		.432**	.113
W Chains4	.481**	.373**	.454**	.530*	.320**	.542**		.334**
Orth Choic	.630**	.548**	.589**	.521**	.247**	.342**	.548**	

Note. Match W=matching words, Match NW=matching non-words, Match Psd=matching pseudohomophones, W Chains=word chains, Orth Choic=orthographic choice

*p < .05. **p <.01.

Table 5.13. First-order correlations (lower diagonal) and partial correlations (controlling for age month/form, sex and grade) between the measures of speed of processing in the study

	RAN Let	RAN W	RAN Obj	RAN Col
RAN Let		.266**	.226**	.349**
RAN W	.345**		.049	.170*
RAN Obj	.271**	.151*		.475**
RAN Col	.394**	.303**	.568**	

Note. RAN Let=rapid naming of familiar letters, RAN W=rapid naming of familiar words, RAN Obj=rapid naming of familiar objects, RAN Col=rapid naming of familiar colours

*p < .05. **p <.01.

5.3.3 Persian literacy model

Based on the descriptive statistics and relationships discussed above, the experimental measures were factor analysed to determine the underlying factors that could summarize the results and inform the development of a literacy model for the Persian language. The measures entered into this analyses were: Reading Comprehension Cloze, Reading Comprehension Questions, Listening Comprehension, Vocabulary, Non-word Reading Fluency, Sound Deletion, Matching Words, Matching Non-words, Matching Pseudohomophones, Word Chains 1, 2, 3, 4, Orthographic Choice, RAN Letters, RAN Words, RAN Objects and RAN Colours along with grade and age of participants.

Since the study was exploratory in nature, a principal components analysis was carried out using unity in the major diagonal. Following the Kaiser criterion, the extraction method was based on Eigen values greater than 1.0. The Rotation method used was the Varimax method. (In addition, the second analysis used the Oblimin Rotation method but the solution discussed and factors produced were consistent with that of the initial analysis). This produced Table 5.14 with the loadings greater than 0.4 bolded. It was possible to summarize over 65% of the variance with four factors. This four-factor solution provided the most parsimonious explanation of the data.

These four factors can be summarized and named as follow:

Factor 1: Language-related skills

This factor includes text comprehension as well as language ability. It also includes school grades and age of the participants which suggests that it is influenced by growth in the child's experience. The loadings of the Orthographic Choice and the Rapid Naming of Familiar

Words measures on this factor would argue for these measures to show a large effect of learning and reading experience.

Factor 2: Orthographic skills

This factor has the elements of orthography in common: the three Matching tasks and the Word Chains 1 task loaded onto this factor. Similar to factor 1, the loadings of the participants' grade and age are evidence of an effect of learning.

Factor 3: Phonological skills

Sound Deletion, Non-word Reading Fluency, and Rapid Naming of Objects loaded onto this factor. Interestingly, the Word Chains tasks apart from the Word Chains 1 loaded onto this factor which may argue for the nature of this task for Persian orthography as a relatively transparent orthography. This will be discussed further later in this thesis.

Factor 4: Speed of processing

This factor combines the Rapid Naming measures of Familiar Letters, Objects and Colours, together with the Non-word Reading Fluency measure.

Table 5.14. Factor analyses (Rotated Component Matrix) for development of the literacy model for the Persian language

	Components			
	1	2	3	4
Reading Comprehension Cloze	**.654**	.270	**.407**	.291
Reading Comprehension Questions	**.708**	.268	.336	.272
Listening Comprehension	**.764**	.008	.254	.055
Vocabulary	**.716**	.213	.118	.044
Non-word Reading Fluency	.361	.288	**.441**	**.502**
Sound Deletion	.098	.065	**.762**	.002
Matching Words	.333	**.759**	.138	.266
Matching Non-words	.274	**.749**	.066	.276
Matching Pseudohomophones	.353	**.704**	.142	.240
Word Chains 1	.372	**.596**	**.460**	.033
Word Chains 2	.174	.364	**.445**	-.172
Word Chains 3	.238	.010	**.619**	**.401**
Word Chains 4	**.449**	.277	**.464**	.321
Orthographic Choice	**.680**	.374	.187	.270
RAN Letters	-.099	-.104	.111	**-.813**
RAN Words	**-.508**	-.224	-.053	-.369
RAN Objects	-.053	-.358	**-.425**	**-.497**
RAN Colours	-.264	-.241	-.242	**-.626**
School Grade of Child	**.790**	**.427**	.069	.119
Age of Child in Months	**.797**	**.414**	.053	.133

Note. Factor loadings over .40 appear in bold.

5.3.4 Predictors of reading comprehension

The results of the factor analyses suggested that language related skills, phonological/decoding skills, orthographic skills and speed of processing are the four major sets of skills underlying reading comprehension in the current study. Whole-cohort stepwise

regression analyses were then performed on the results to assess the level of prediction provided by combinations of measures in the study.

Consistent with the Simple View of Reading (Gough and Tunmer, 1986; Tunmer and Chapman, 2012) and the Component Model of Reading (Joshi and Aron, 2000), both text comprehension measures were used as dependant variables (DV) controlling for age (in months), sex and grade of child. The predictor variables were then entered in the model. The measures used in this model were as follows: Listening Comprehension, Vocabulary, Sound Deletion, Non-word Reading Fluency, Matching Words (as the three Matching tasks developed for this study proved to be highly interrelated, the Matching Non-words and Pseudohomophones were not used; the rationale being to increase the power of regression model by limiting the number of variables), Word Chains 1 (Word Chains 2,3, and 4 were not used in analyses due to the results of the factor analyses which argued for different nature of this task in Persian; the Word Chains 2,3, and 4 loaded onto the phonological skills factor), Orthographic Choice, RAN Words and Objects (as the RAN letters, objects and colours proved to be highly interrelated and they all loaded onto the speed factor, the RAN Objects was selected to represent general speed of processing along with the RAN Words to represent literacy speed of processing consistent with similar studies in the literature).

Tables 5.15 and 5.16 present the results of a stepwise regression analysis for the Reading Comprehension Cloze and Questions, respectively. The results were largely consistent with the Simple View of Reading. Text comprehension in Persian seems to be predicted by word-level skills as well as understanding-level skills. However, in contrast with the Component Model of Reading, Speed measures in the study showed no significant prediction in the model (this will be further explored throughout this chapter along with the general discussion chapter).

Table 5.15. Results of a stepwise regression analysis to investigate predictors of reading comprehension (Cloze)

Steps	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
Controlled	.434	.434	F=43.19, p <.001	Sex	.098
				Age	.226
				Grade	-.061
1	.534	.100	F=36.10, p <.001	Non-word Fluency	.204
2	.574	.053	F=21.37, p<.001	Vocabulary	.237
3	.613	.040	F=17.72, p<.001	Matching Words	.237
4	.628	.017	F=7.67, p=.006	Listening Comprehension	.147
5	.638	.011	F=5.43, p=.021	Sound Deletion	.120

Table 5.16. Results of a stepwise regression analysis to investigate predictors of reading comprehension (Questions)

Steps	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
Controlled	.522	.522	F=62.10, *p*<.001	Sex	.115
				Age	.190
				Grade	.059
1	.592	.069	F=28.74, *p*<.001	Orthographic Choice	.224
2	.626	.035	F=15.55, *p*<.001	Listening Comprehension	.201
3	.656	.029	F=14.21, *p*<.001	Non-word reading Fluency	.174
4	.667	.012	F=5.84, *p*=.017	Word Chains 1	.149

The stepwise regression analyses were then followed by whole-cohort hierarchical regression analyses to assess the level of prediction provided by combinations of measures in the study. Similar to the stepwise regression models, both text comprehension measures were used as DV (see Table 5.17 and Table 5.18 for the Comprehension Cloze and Questions, respectively), with the remaining variables (understanding-level and word-level skills) entered in a prescribed order after participant control variables (age in months, sex and grade). The predictor variables were entered in a prescribed order: first language-related measures (i.e., the Listening Comprehension and Vocabulary measures), then phonological/decoding skills (i.e., the Sound Deletion and Non-word Reading Fluency measures), orthographical skills (i.e., the Matching Words, Word Chains 1 and Orthographic

Choice measures) along with the speed of processing (i.e., the RAN Words and RAN Objects measures).

Table 5.17. Results of a hierarchical regression analysis to investigate predictors of reading comprehension (Cloze)

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.434	.434	F=43.18 *p*<.001	Sex	.067
					Grade	-.108
					Age	.187
2	Language related Skills	.540	.106	F=19.26 *p*<.001	Listening Comp.	.130
					Vocabulary	.223
3	Phonological/Decoding Skills	.619	.079	F=17.12 *p*<.001	Sound Deletion	.087
					Non-word Fluency	.141
4	Orthographic Skills	.662	.043	F=6.80 *p*<.001	Matching Words	.169
					Word Chains 1	.061
					Orthographic Choice	.112
5	Speed of Processing	.669	.007	F= .67 *p*=.187	RAN Words	-.057
					RAN Objects	-.095

Table 5.18. Results of a hierarchical regression analysis to investigate predictors of reading comprehension (Questions)

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.522	.522	F=62 *p*<.001	Sex	.116
					Grade	.056
					Age	.177
2	Language related Skills	.593	.071	F=14.67 *p*<.001	Listening Comp.	.197
					Vocabulary	.036
3	Phonological/Decoding Skills	.642	.048	F=11.20 *p*<.001	Sound Deletion	.031
					Non-word Fluency	.125
4	Orthographic Skills	.670	.028	F=4.75 *p*=.004	Matching Words	.028
					Word Chains 1	.116
					Orthographic Choice	.189
5	Speed of Processing	.673	.004	F=.90 *p*=.406	RAN Words	-.042
					RAN Objects	-.068

The results indicated a similar pattern of predictors across the two reading comprehension measures. The combined model predicted roughly about 70% of the variability in both Reading Comprehension measures (Cloze and Questions). All variables entered into these analyses except the speed of processing measures predicted independent variability.

Similar hierarchical regression analyses were performed focusing on each grade (grade 2 to 5) to investigate the trend of predictors from fairly early stages of literacy skills (grade 2) to relatively experienced readers (grade 5). Consistent with the whole-cohort hierarchical

regression models, both text comprehension measures were used as DVs, with the remaining variables (understanding-level and word-level skills) entered in a prescribed order after participant control variables (age in months, sex and grade): first language-related measures (i.e., the Listening Comprehension and Vocabulary measures), then phonological/decoding skills (i.e., the Sound Deletion and Non-word Reading Fluency measures), orthographical skills (i.e., the Matching Words, Word Chains 1 and Orthographic Choice measures) along with the speed of processing (i.e., the RAN Words and RAN Objects measures). Tables 5.19 – 5.22 and tables 5.23 – 5.26 present the results for the Comprehension Cloze and Questions, respectively per grade.

Table 5.19. Results of a hierarchical regression analysis to investigate predictors of reading comprehension (Cloze) for grade 2

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex and Age	.005	.005	F=.08 *p*=.921	Sex	.004
					Age	-.119
2	Language related Skills	.385	.380	F=10.51 *p*<.001	Listening Comp.	.295
					Vocabulary	.328
3	Phonological/Decoding Skills	.458	.073	F=2.15 *p*=.133	Sound Deletion	.144
					Non-word Fluency	-.164
4	Orthographic Skills	.654	.196	F=5.47 *p*=.004	Matching Words	.170
					Word Chains 1	-.062
					Orthographic Choice	.303
5	Speed of Processing	.678	.024	F=1.00 *p*=.378	RAN Words	-.195
					RAN Objects	-.046

Table 5.20. Results of a hierarchical regression analysis to investigate predictors of reading comprehension (Cloze) for grade 3

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex and Age	.044	.044	F=1.05 *p*=.360	Sex	.021
					Age	.049
2	Language related Skills	.308	.264	F=8.19 *p*=.001	Listening Comp.	.251
					Vocabulary	.224
3	Phonological/Decoding Skills	.466	.158	F=6.08 *p*=.005	Sound Deletion	.264
					Non-word Fluency	.233
4	Orthographic Skills	.512	.046	F=1.19 *p*=.327	Matching Words	.201
					Word Chains 1	.135
					Orthographic Choice	.034
5	Speed of Processing	.519	.007	F= .27 *p*=.767	RAN Words	.082
					RAN Objects	.096

Table 5.21. Results of a hierarchical regression analysis to investigate predictors of reading comprehension (Cloze) for grade 4

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex and Age	.102	.102	F=2.28 *p*=.116	Sex	.171
					Age	.009
2	Language related Skills	.216	.114	F=2.77 *p*=.076	Listening Comp.	.143
					Vocabulary	.137
3	Phonological/Decoding Skills	.450	.233	F=7.64 *p*=.002	Sound Deletion	-.374
					Non-word Fluency	.211
4	Orthographic Skills	.564	.114	F=2.89 *p*=.050	Matching Words	.081
					Word Chains 1	.312
					Orthographic Choice	.230
5	Speed of Processing	.625	.061	F= 2.52 *p*=.097	RAN Words	-.276
					RAN Objects	-.238

Table 5.22. Results of a hierarchical regression analysis to investigate predictors of reading comprehension (Cloze) for grade 5

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex and Age	.134	.134	F=3.10 *p*=.056	Sex	.216
					Age	.176
2	Language related Skills	.293	.159	F=4.28 *p*=.021	Listening Comp.	.051
					Vocabulary	.111
3	Phonological/Decoding Skills	.377	.084	F=2.42 *p*=.104	Sound Deletion	.253
					Non-word Fluency	-.133
4	Orthographic Skills	.495	.118	F=2.57 *p*=.071	Matching Words	.200
					Word Chains 1	.151
					Orthographic Choice	-.013
5	Speed of Processing	.584	.089	F= 3.32 *p*=.049	RAN Words	-.095
					RAN Objects	-.386

Table 5.23. Results of a hierarchical regression analysis to investigate predictors of reading comprehension (Questions) for grade 2

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex and Age	.023	.023	F=.45 *p*=.663	Sex	-.051
					Age	-.133
2	Language related Skills	.146	.124	F=2.46 *p*=.10	Listening Comp.	.218
					Vocabulary	.038
3	Phonological/Decoding Skills	.277	.131	F=2.89 *p*=.07	Sound Deletion	-.176
					Non-word Fluency	.298
4	Orthographic Skills	.349	.073	F=1.08 *p*=.374	Matching Words	.055
					Word Chains 1	.010
					Orthographic Choice	.172
5	Speed of Processing	.390	.041	F= .91 *p*=.416	RAN Words	-.232
					RAN Objects	-.103

Table 5.24. Results of a hierarchical regression analysis to investigate predictors of reading comprehension (Questions) for grade 3

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex and Age	.211	.211	F=6.01 *p*=.005	Sex	.311
					Age	.145
2	Language related Skills	.373	.162	F=5.51 *p*=.007	Listening Comp.	.302
					Vocabulary	.116
3	Phonological/Decoding Skills	.481	.108	F=4.29 *p*=.02	Sound Deletion	.055
					Non-word Fluency	.405
4	Orthographic Skills	.482	.001	F=.03 *p*=.993	Matching Words	-.027
					Word Chains 1	.039
					Orthographic Choice	.000
5	Speed of Processing	.495	.012	F= .43 *p*=.652	RAN Words	.052
					RAN Objects	.151

Table 5.25. Results of a hierarchical regression analysis to investigate predictors of reading comprehension (Questions) for grade 4

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex and Age	.057	.057	F=1.24 *p*=.005	Sex	.148
					Age	.074
2	Language related Skills	.252	.195	F=5.09 *p*=.007	Listening Comp.	.009
					Vocabulary	.336
3	Phonological/Decoding Skills	.384	.132	F=3.95 *p*=.02	Sound Deletion	-.051
					Non-word Fluency	.106
4	Orthographic Skills	.508	.124	F=2.85 *p*=.993	Matching Words	-.094
					Word Chains 1	.204
					Orthographic Choice	.438
5	Speed of Processing	.514	.006	F= .21 *p*=.652	RAN Words	-.001
					RAN Objects	-.091

Table 5.26. Results of a hierarchical regression analysis to investigate predictors of reading comprehension (Questions) for grade 5

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex and Age	.067	.067	F=1.43 *p*=.252	Sex	.312
					Age	.012
2	Language related Skills	.334	.268	F=7.64 *p*=.002	Listening Comp.	.365
					Vocabulary	.026
3	Phonological/Decoding Skills	.395	.061	F=1.81 *p*=.178	Sound Deletion	.208
					Non-word Fluency	-.271
4	Orthographic Skills	.447	.052	F=1.03 *p*=.391	Matching Words	-.010
					Word Chains 1	.171
					Orthographic Choice	.163
5	Speed of Processing	.565	.118	F= 7.19 *p*=.024	RAN Words	.101
					RAN Objects	-.466

Overall, the analyses suggested that language related skills predict a relatively large amount of variability in both Reading Comprehension measures across grades in reverse pattern; the level of prediction is ascending in the Comprehension Questions but descending in the Cloze. Language related skills were represented by the Listening Comprehension and Vocabulary measures. The Vocabulary measure explained a larger amount of variability in the Cloze task in grade 2 (35%).

In addition to understanding-level skills, word-level skills were found to be good predictors in this study. Phonological/decoding skills proved to be reasonable predictors for both reading comprehension measures across grades. Orthographic skills also showed relatively

reasonable level of prediction across grades, particularly for the Cloze measure. Phonological/decoding skills were represented by the Sound Deletion and Non-Word Reading Fluency measures and orthographic skills were represented by the Matching Words, Word Chains 1, and Orthographic Choice measures.

Interestingly, the speed of processing measures proved to show non-significant levels of variability explained except at grade 5. At this grade level, RAN Objects predicted unique variability, which may argue for general speed of processing skills supporting Persian text comprehension in higher grades.

To further assess unique contributions to Persian text comprehension, an additional set of whole-cohort regression analyses were conducted, this time with the Non-word Reading Fluency measure separated from the phonological skills measures and entered as the last step. These alternative entry sequences were performed to determine unique contributions for decoding skills to Persian reading comprehension, but also to assess underlying cognitive-linguistic influences without variability due to decoding skills being explained. Tables 5.27 and 5.28 show the results for the Comprehension Cloze and Questions, respectively.

Table 5.27. Results of a hierarchical regression analysis to investigate predictors of reading comprehension (Cloze) across grades treating the Non-word Reading Fluency separately

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.434	.434	F=43.18 *p*<.001	Sex	.067
					Grade	-.108
					Age	.187
2	Language related Skills	.540	.106	F=19.56 *p*<.001	Listening Comp.	.130
					Vocabulary	.223
3	Phonologic Skills	.578	.038	F=15.14 *p*<.001	Sound Deletion	.087
4	Orthographic Skills	.644	.065	F=9.97 *p*<.001	Matching Words	.169
					Word Chains 1	.061
					Orthographic Choice	.112
5	Speed of Processing	.659	.016	F= 3.68 *p*=.027	RAN Words	-.057
					RAN Objects	-.095
6	Decoding Skills	.669	.009	F=4.47 *p*=.036	Non-word Fluency	.141

Table 5.28. Results of a hierarchical regression analysis to investigate predictors of reading comprehension across grades (Questions) treating the Non-word Reading Fluency separately

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.522	.522	F=61.99 *p*<.001	Sex	.116
					Grade	.056
					Age	.177
2	Language related Skills	.593	.071	F=14.67 *p*<.001	Listening Comp.	.197
					Vocabulary	.036
3	Phonologic Skills	.614	.020	F=8.69 *p*=.004	Sound Deletion	.031
4	Orthographical Skills	.657	.043	F=6.85 *p*<.001	Matching Words	.028
					Word Chains 1	.116
					Orthographic Choice	.189
5	Speed of Processing	.666	.009	F= 2.27 *p*=.107	RAN Words	-.042
					RAN Objects	-.068
6	Decoding Skills	.673	.007	F=3.6 *p*=.06	Non-word Fluency	.125

The results indicated a similar pattern of predictors across the two reading comprehension measures, and treating Non-word Fluency separately did not add to interpretations of the model substantially. Both phonological and orthographic measures showed significant levels of prediction of variability in these analyses. Though, interestingly, the orthographic skills level of prediction of the Comprehension Questions task remained fairly consistent across analyses, which may suggest that the influence of orthographic skills on this comprehension task is not simply due to relationships with word identification processes. Additionally, speed

of processing becomes a significant predictor of the Comprehension Cloze task when Non-word Fluency is entered last in the sequence, though this may be due to the Cloze procedure putting more emphasis on speeded responses, which would be explained by the fluency elements of the Non-word Fluency task, rather than comprehension its self.

5.3.5 Predictors of decoding

To assess the level of prediction provided by combinations of measures of word-level skills in the study, whole-cohort hierarchical regression analyses were performed. The Non-Word Reading Fluency measure representing decoding skills was used as the DV with the remaining variables entered in a prescribed order: first age (in months), sex and grade of child were entered to control for effects of these variables, then the predictor variables were entered, starting with the phonological skills measure (the Sound Deletion measure), the orthographical skills measures (the Matching Words, Word Chains 1, and Orthographic Choice measures), the speed of processing measures (the RAN Words and RAN Objects), and finally the linguistic comprehension measures (the Listening Comprehension and Vocabulary) (see Table 5.29).

Table 5.29. Results of a regression analysis to investigate predictors of decoding

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.304	.304	F=24.74 *p*<.001	Sex	.062
					Grade	-.260
					Age	.330
2	Phonological Skills	.403	.099	F=28.17 *p*<.001	Sound Deletion	.188
3	Orthographic Skills	.464	.060	F=6.22 *p*<.001	Matching Words	.067
					Word Chains 1	.113
					Orthographic Choice	.084
4	Speed of Processing	.530	.066	F= 11.59 *p*<.001	RAN Words	-.188
					RAN Objects	-.257
5	Language related Skills	.534	.004	F=.76 *p*=.471	Listening Comp.	.029
					Vocabulary	.070

The results indicated that all variables entered into this analysis, except the linguistic comprehension measures, predict independent variability, with the best predictors being phonological skills and processing speed. To further analyze the prediction levels across grades (grade 2 to 5), the same analyses were performed on each grade (see Table 5.30 – Table 5.33 for analyses per grade).

Table 5.30. Results of a regression analysis to investigate predictors of decoding for grade 2

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.164	.164	F=3.53 *p*=.04	Sex	.162
					Age	.224
2	Phonological Skills	.347	.183	F=9.80 *p*=.004	Sound Deletion	.327
3	Orthographic Skills	.441	.094	F=1.80 *p*=.168	Matching Words	-.040
					Word Chains 1	.294
					Orthographic Choice	.092
4	Speed of Processing	.471	.030	F= .58 *p*=.434	RAN Words	-.174
					RAN Objects	-.101
5	Language related Skills	.529	.057	F=1.70 *p*=.2	Listening Comp.	.165
					Vocabulary	-.275

Table 5.31. Results of a regression analysis to investigate predictors of decoding for grade 3

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.046	.046	F=1.09 *p*=.343	Sex	-.060
					Age	.043
2	Phonological Skills	.151	.105	F=5.43 *p*=.024	Sound Deletion	.189
3	Orthographic Skills	.349	.198	F=4.14 *p*=.012	Matching Words	.146
					Word Chains 1	.021
					Orthographic Choice	.224
4	Speed of Processing	.434	.085	F= 2.93 *p*=.065	RAN Words	-.177
					RAN Objects	-.362
5	Language related Skills	.439	.005	F=.17 *p*=.846	Listening Comp.	-.077
					Vocabulary	.070

Table 5.32. Results of a regression analysis to investigate predictors of decoding for grade 4

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.165	.165	F=4.04 *p*=.025	Sex	-.172
					Age	.137
2	Phonological Skills	.221	.057	F=2.90 *p*=.69	Sound Deletion	-.133
3	Orthographic Skills	.355	.134	F=2.56 *p*=.07	Matching Words	-.010
					Word Chains 1	.125
					Orthographic Choice	.299
4	Speed of Processing	.537	.181	F= 6.85 *p*=.003	RAN Words	-.425
					RAN Objects	-.310
5	Language related Skills	.566	.029	F=1.11 *p*=.34	Listening Comp.	.104
					Vocabulary	.122

Table 5.33. Results of a regression analysis to investigate predictors of decoding for grade 5

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.194	.194	F=4.79 *p*=.014	Sex	.343
					Age	.210
2	Phonological Skills	.346	.153	F=9.11 *p*=.004	Sound Deletion	.245
3	Orthographic Skills	.376	.030	F=.56 *p*=.64	Matching Words	-.244
					Word Chains 1	.129
					Orthographic Choice	-.078
4	Speed of Processing	.645	.269	F= 12.91 *p*<.001	RAN Words	-.387
					RAN Objects	-.355
5	Language related Skills	.648	.002	F=.11 *p*=.898	Listening Comp.	-.009
					Vocabulary	-.060

The results suggest that phonological and orthographic skills tend to be better predictors in the lower grades, whereas speed of processing proved to be a relatively stronger predictor in higher grades. This may suggest that lower graders tend to use skills that focus on parts of word, whereas more experienced readers may be able to rely more on whole word skills in decoding. However, clearly phonological, orthographic and speeded access processes seem important for decoding fluency.

5.3.6 Model based on results of Study 1

Overall, the findings indicated that Persian reading comprehension levels were predicted by understanding-level and word-level skills, and word-level skills to be predicted by

phonological skills, orthographic skills and speeded access. In addition, orthographic skills and general speed of processing may predict text reading comprehension in Persian independent of the influence of decoding skills. In the case of speed of processing, this seems to be primarily in higher grades. This can be summarized in the model represented in Fig.5.1.

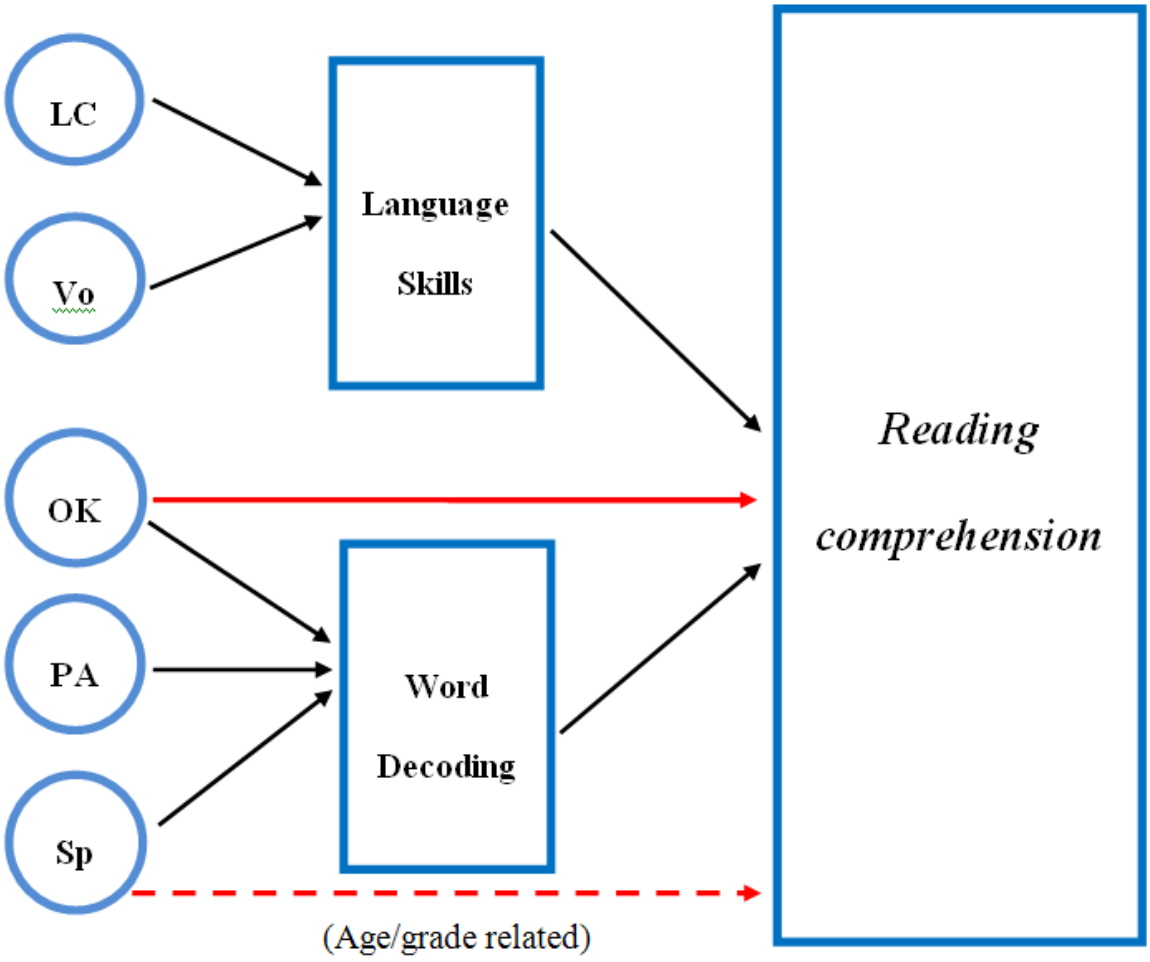

Fig. 5.1. Monolingual Persian literacy model

Note. LC=listening comprehension, Vo=vocabulary, PA=phonological awareness, OK= orthographic knowledge, Sp=speed

5.4 Discussion

The primary objective of this study was to examine underlying cognitive-linguistic skills related to Persian reading comprehension. The skills tested were based on those derived from a consideration of the Simple View of Reading (Gough and Tunmer, 1986; Hoover & Gough, 1990; Tunmer and Chapman, 2012) and the Component Model of Reading (Joshi and Aaron, 2000). These theories were primary in the development of the skills areas tested due to their focus on both word level and comprehension levels processes, but also because of their potential to provide explanations of reading development across languages (Goswami, 2012; Goulandris & Snowling, 2003). The measures used in this study proved to be reasonable indicators of Persian reading comprehension levels across all grades tested (Grade 2 to 5). The findings indicated that Persian reading comprehension levels can be predicted by measures of linguistic competence and word decoding, with the latter being predicted by phonological and orthographic processing skills. It is evident that no matter how shallow or deep an orthography is, words seem to be decoded through phonology mapping and orthographic mapping (the dual-route model and connectionist/triangle models) (Coltheart, 2006; Plaut et al., 1996). The ceiling effects that were evident in the non-word reading measure (representing decoding skill), which led to the consideration of the non-word reading fluency to assess decoding skill, were consistent with the relatively high transparency level of the orthography in Persian. However, somewhat different to what might be predicted from the English-language data, orthographic measures directly predicted Persian reading comprehension from an early grade and speed of processing showed significant contributions in older grades. Both of these findings are worthy of further discussion.

The orthographic measures in this study were generally inter-correlated; though the Word Chains measures showed mixed relationships. The results of the factor analyses (see Table

5.14) indicated that most of the orthographic skills measures loaded onto the orthographic skills factor. The Word Chains 1 task (the main task used in subsequent analyses) also loaded primarily onto this orthographic factor, in contrast to the other Word Chains tasks loaded onto the phonological skills factor: further research will be needed to address this effect in the Persian orthography (see also discussion in Asbjørnsen, Obrzut, Eikeland, & Manger, 2010, related to Norwegian). Despite the need for further research to clarify influences in such word chains tasks, when the inter-related orthographic measures in this study were considered, they predicted word decoding skills from an early age, arguing for the possibility that orthographic knowledge is an important early skill for a person to be able to read accurately/fluently in Persian – clearly, it would be interesting to consider this influence on word-level reading in grade 1 Iranian children who will experience mainly vowelized text. In addition, analyses across grades suggested that, as well as expected influences of phonological processing, the lower grade children tended to rely more on orthographic knowledge to support decoding whereas for older children (grade 3 and above) there was a trend for speeded processing to be more influential of decoding. Again, the inter-relationships between orthographic knowledge and speeded processing, and their influence on word reading in Persian, seem worthy of further (longitudinal) research.

When reading comprehension is considered, and potentially in contrast to the findings in English, orthographic knowledge seemed to directly predict Persian reading comprehension across the grade/reading experience levels assessed in this work after controlling for word recognition. The possible explanation would be in line with the orthographic depth hypothesis (Frost et al., 1987 and Katz & Frost, 1992) which states that readers adopt a strategy based on orthographic transparency. Research suggests that readers of transparent orthography can rely on grapheme-phoneme conversion, whereas readers of complex orthography would rely more on orthographic whole-word reading (Wimmer & Goswami,

1994). However, as discussed in this thesis, Persian readers are exposed to a quite complex orthography in which text can be either vowelized (and hence reasonably transparent) or unvowelized (potentially producing a large number of homographs), with letters changing their shape based on word position and how they connect to surrounding letters. This potential complexity of orthography may make the relationship between orthographic processing and reading stronger – it may be, for example, that text reading experience, and the skills associated with dealing with text understanding, may improve orthographic knowledge as much as orthographic skills support reading acquisition.

In addition, the role of morphology in the Persian language and orthography may need to be considered – though further research is necessary to confirm its importance. Similar to English, morphemes in Persian identify lexical meaning as well as grammatical function. However, there are a huge number of borrowed Arabic words in Persian and these follow different morphological rules due to their Semitic background (see Mahfoudhi, Elbeheri, Al-Rashidi, & Everatt, 2010). This, also, will add to the potential complexity of processing orthographic features. Again, the reader may need to adopt a strategy to deal with these complexities through their experience with reading and text understanding. However, this interpretation will require longitudinal data collection that was beyond the time-limitations of the present work. (The relationship between reading comprehension and orthographic skills in Persian will be further discussed in the General Discussion chapter of this thesis after two more chapters of data.)

Speed of processing (as assessed by the RAN measures in this study) also showed evidence of influencing word decoding and text comprehension, though the latter was evident with the older children (those in Grade 5) tested. These findings suggest that speed of processing is more of an indirect influence on reading comprehension via word decoding, a finding

somewhat at odds with the Component Model of Reading which has argued for speed to be an independent influence of reading comprehension. One interpretation of this may again consider the variable transparency of the orthography. Although Persian may be relatively transparent in its vowelized form, it may show features more consistent with a less transparent orthography due to the use of the non-vowelized form in most texts experienced by children in grade 2 and above. Hence, the independent influence of speed on reading comprehension may take some time to be evident, unlike with more transparent orthographies. One problem with this interpretation is that it seems somewhat at odds with the current findings that the non-word reading measure showed ceiling effects in accuracy. This effect is more consistent with a relatively transparent orthography – although the influence of teaching programme (for example, a focus on phonics and links between letters and sounds) may need to be considered also. Clearly, further research is needed to determine the effects of speeded accessing of verbal labels within Persian. However, overall, the findings may be interpreted as arguing for the need to teach the link between the written form (orthography) and language sounds (phonology) directly, but also for the importance of recognising characteristics of the orthography to support literacy learning skills.

5.5 Conclusion

Analyses from this study indicated that Persian reading comprehension levels were best predicted by measures of linguistic processing and decoding ability, with the latter being predicted by phonological and orthographic processing skills. There was evidence of orthographic knowledge directly predicting Persian reading comprehension from an early grade and for speed of processing to be significant in older grades. These findings were discussed in terms of the application of the Simple View of Reading to Persian, and argued for the Persian reading comprehension model outlined in Figure 5.1.

Study 1 was conducted on monolingual Persian speakers. In order to further investigate the model developed, Study 2 was performed to investigate predictors of Persian text reading comprehension within a Persian-English bilingual cohort.

Chapter 6

Study 2

Models of Reading Comprehension

Investigations into Persian-English Bilingual Speakers

6.1 Introduction

The findings of Study 1 (reported in Chapter 5) argued for a Persian reading comprehension model which is, to a large extent, similar to English-language derived models (e.g., the simple view of reading) despite the orthographic differences between the two languages (i.e., English and Persian). This is of interest particularly given that the written form of the Persian language is very different from the written form of English. Persian characters share few visual similarities with their Roman counterparts. Persian is cursive and written from right to left with letters changing shapes when connected to the preceding or following letters. The orthography is fully vowelized for the beginner readers, a form that is relatively transparent. However, the diacritic marks that represent short vowels are not included in texts aimed at more experienced readers (from grade 2 primary school), which means that simple spelling-sound conversion needs to be supplemented by context in order to process meaning/pronunciation. Despite its relative transparency compared to some orthographies, such as English, Persian is polygraphic with up to four letters (graphemes) standing for one sound (phoneme) (e.g., these four graphemes ز, ذ, ض, ظ correspond to the phoneme /z/, and

the three graphemes ث, س, ص correspond with the phoneme /s/). However, this should not impose any problems in terms of reading because any given letter consistently has the same pronunciation (see chapter 3 for review on the Persian orthography).

The Persian model of reading (proposed in this thesis – Chapter 5) suggests that Persian reading comprehension levels are predicted by measures of linguistic competence and word decoding, with the latter being predicted by phonological and orthographic processing skills. However, orthographic skills and speed of processing shows predictions of Persian reading comprehension that are independent of word decoding processes. To investigate further this Persian model of reading, Study 2 was conducted amongst bilingual Persian-English children through a cross sectional (school grade 2 to 5) and cross linguistic (Persian and English languages) design which measured skills amongst the participants who attended mainstream English medium schools in New Zealand or Australia but whose home language was Persian. The participants attended community schools to acquire and/or maintain their native language (i.e., Persian) literacy (reading and writing) skills.

The aim of the study was to test the Persian model of reading comprehension (developed in this thesis) and compare it with the English models (e.g., SVR). Similar to Study 1, the concern here was not with between-group comparisons, but verifying the relative contribution of several theoretically relevant abilities (cognitive-linguistic processes) to the prediction of text comprehension skills in a group of bilingual learners who were acquiring Persian literacy skills as part of their second language literacy skills. Analyses of the data produced by this cohort were used to determine whether the targeted underlying cognitive-linguistic skills (i.e., verbal skills, phonological skills, orthographic skills and speed of processing reported in Study 1) were significant predictors of Persian reading comprehension as would be the case if the suggested model of reading comprehension is applicable to monolingual Persian speakers.

Given the results, these findings can be used to inform the proposed model of Persian reading comprehension in this thesis. The study also aimed at examining intra-language influences, such as first language (in this case English – see discussion in the Participants section below) skills supporting second language (Persian in this case) literacy development, and whether these may need to be taken into account in the proposed model of reading.

6.2 Methodology

Following Educational Research Human Ethics[4] approval and relevant approvals from the community schools in New Zealand and Australia to conduct the study, standard procedures, confidentiality of participants and parental permission for entry into the study were followed. Five research assistants with experience of teaching young children were recruited and trained to administer the test materials using the same procedure for each individual. Research assistants were language teachers with a minimum of two years of experience working with young children. The research assistants were trained and provided step by step instructions on the administration of the test materials. They were also supervised by the researcher throughout the testing session when necessary.

6.2.1 Participants

The participants in this study were recruited from Persian speaking communities in New Zealand and Australia. These were Persian children (Iranian or Afghan decent) who either were born in New Zealand or Australia or moved to either of these countries at a fairly young age (most of the children have lived in New Zealand or Australia for several years – typically about 7 years). The children were all bilingual Persian-English speakers with the English

[4] The University of Canterbury's Educational Research Human Ethics Committee approved the study.

language as their preferred (dominant) spoken language (L1) and Persian language as their second (home) language (L2) based on parent/teacher interviews and observations of the children in the school playground that focussed on the language they spoke: this was English. However, the children's home language was Persian, either Dari or Farsi (Persian dialect spoken in Afghanistan is called Dari and the local name for the Persian language spoken in Iran is Farsi or Parsi), and they attended Persian literacy community schools on weekends. In addition, the language used during other cultural gatherings, based on the researcher's observation, was also Persian. Therefore, there was a complex relationship between the two languages, the use of which was linked to social context. However, given use and preference, English was considered as the participants' first language (L1) and Persian as their second language (L2) for the purpose of this study. To have a more homogenous cohort, those children who recently moved to New Zealand or Australia and attended English for Speakers of Other Languages (ESOL) programs (N=2) were not recruited for this study. For all participants included in the current study, there were no reported/known learning difficulties.

The data was collected from two communities in New Zealand and four in Australia. All children used Persian literacy books (reading and writing skills) imported from Iran with grade specification similar to monolingual Persian children in Iran, consistent with those reported in Study 1: schools in Iran, regardless of geographical location, use the same curriculum, with textbooks being exactly the same across schools. Since these children had a limited number of hours of Persian literacy learning lessons on weekends, they accomplished each school grade (compared to the Iranian school system) within two years. The children in New Zealand had two-hour community lessons and children in Australia had four hours of Persian literacy lessons with better educational equipment – the community schools in Australia provided snacks for children and there was some time to play during breaks. The level of literacy training available at weekend community schools meant that the participants

were older, on average, than the cohort reported in Study 1 despite being on the same school grades (grade 2 to 5) in Persian. A total of 146 children in Persian grades 2 to 5 (as determined by community school staff) were available at the time of testing in their community schools. Roughly, half of these children were male and the other half were female, with the majority been originally from Afghanistan (see Table 6.1 for demographic information).

As noted previously in this thesis, the Persian language, called Farsi or Parsi in Iran and Dari in Afghanistan, has various regional accents. Therefore, participants in this study were tested using the Persian accent that they were more familiar with. Hence, the audio materials (e.g., tests of sound deletion, listening comprehension and vocabulary) used in Study 1 were modified based on the accentual differences observed in the Persian language of the cohort. The same procedure was utilized for the cohort's English accent due to slight differences between the two accents (i.e., New Zealand and Australian accent) with test materials adopting the same popular accent for the participants to reduce language understanding barriers due to differences in accents.

Table 6.1. Demographics – Number of participants, range and mean age in months per grade

Persian school grade of participants		2	3	4	5	Total
Sex of child	male	29	14	13	7	63
	female	33	17	20	13	83
Ethnicity	Iranian	10	2	5	11	28
	Afghans	52	29	28	9	118
Background	NZ	35	11	17	1	64
	Australia	27	20	16	19	82
Age in months	Mean	146	160	157	159	153
	Range	(90-233)	(105-212)	(116-197)	(123-270)	(90-270)

Data from 126 participants was analysed. Table 6.2 presents a brief summary of why certain participants were not selected for analyses. Participants selected for inclusion in the analyses were all those who performed the comprehension measures; hence, any participants who did not perform the comprehension measures due to absenteeism were deselected (N=13). Those participants with recognized problems were not included in the analyses (N=4). These comprised: (i) two children who moved to New Zealand or Australia very recently and attended ESOL programs for their English proficiency, therefore their English ability was not comparable to the rest of the participants; (ii) one child's background language was Arabic meaning that they could not verbally communicate well in Persian; and (iii) one participant was too old (22.5 years of age) for the study. Finally, there were three children who quit after some test sessions; one thought the tests were too simple for her, a second (the younger sister of the first) seemed to be highly nervous about the test procedures and the third left due to pressure of the others. Unlike Study 1, outlier participants (scoring more than three standard

deviations from the mean in any measures) were not excluded from the analyses; the rationale being that such outliers based on the measures in one language may have performed within the norm range in the other language.

Table 6.2. Summary on case selection

	Frequency	Percent
Total number of children tested	146	100
Children with no comprehension measures	13	8.9
Children with observed difficulties	4	2.7
Children who quit	3	2
Cases analysed	126	86

6.2.2 Measures

An assessment battery comprising 11 tests in each language (i.e., Persian and English, producing a total of 22 tests) was used. The Persian measures were those developed for Study 1 in this thesis (see Chapter 4 for a review of the Persian tests). The English measures were derived from those used in Study 1, but presented in the English language and modified with reference to the literature on which this work is based: as discussed in the test development section of this thesis, Persian measures were developed based on the international, primarily English, literature related to such testing procedures and this literature was returned to in order to make sure that the English versions of measures were appropriate for the aims of the present study. Tests within the battery were designed to measure reading comprehension levels, language skills, phonological/decoding skills, orthographic skills and speed of

processing at elementary levels in the Persian and English language. The participants were tested in one language (Persian or English) at a time.

Tests were administered in two sessions: one involving testing individual children and one where groups of children were tested. In the former, children were tested individually in a quiet room away from distractions within their schools. Record sheets were used to code answers. Group testing occurred in a classroom setting, but children were not allowed to talk or see each other's work. Practice trials were included prior to administration of each test to ensure that the child understood the task requirement. Each test session took approximately 50 minutes including short breaks, with the full testing procedure been performed over several days to avoid fatigue. Although a number of children did not perform all the measures due to absenteeism, it is unlikely that the students stayed away from school to avoid testing since the days for test administration were not advertised and the participants were not aware of the day they were to perform the measures. More likely is that these children did not attend school due to typical reasons for absenteeism (such as illness).

The order of presentation of measures presented to the children was determined so that a concept in one test should allow understanding in a subsequent task. In the individual testing session, the participants were given the following measures in this order: Vocabulary, Sound Deletion, Non-word Reading, RAN Words, RAN Objects. In the group testing session, they were given the following measures in this order: Reading Comprehension Cloze procedure, Reading Comprehension Passage Questions, Listening Comprehension, Matching Words, Orthographic Choice, and Word Chains.

The English Reading Comprehension Cloze and Passage Questions measures were slightly modified from the Neale Analysis of Reading Ability 3rd Edition (NARA-3; Neale, 1999). The English Listening Comprehension measure was modified from the Clinical Evaluation of

Language Fundamentals 4th Edition (CELF-4; Semel, Wiig, Secord, & Hannan, 2008). The test passages were articulated by two children's librarians (one with a native New Zealand English accent and the other with a native Australian English accent) and recorded on a digital voice recorder. These were passages taken from the CELF-4 followed by yes/no questions, similar to the Persian Listening measure. The Non-word reading items were modelled on the WJ III Tests of Cognitive Abilities (Woodcock et al., 2001) and the Quick Incidental Learning (QUIL) (Oetting, Rice, & Swank, 1995), which led to 30 letter strings being selected that comprised the same number of syllables as used in the Persian measure. The Sound Deletion measure was the standardised Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999). The orthographic measures (i.e., Matching Words, Word Chains, and Orthographic Choice) and the measures of speed of processing (i.e., RAN Words, and RAN Objects) were developed so that they comprised the exact number of words and syllables within words as for the Persian measures (see chapter 4 for details of the Persian test measures). Table 6.3 provides an overview of the measures used in this study, with the general area of ability, or skills set, within which they are considered to sit.

Table 6.3. An index of subtests of the assessment battery

Reading Comprehension	Cloze
	Questions
Verbal Skills	Listening Comprehension
	Vocabulary
Phonological/Decoding Skills	Sound Deletion
	Non-word Reading
Orthographic Skills	Matching Words
	Word Chains
	Orthographic Choice
Speed of Processing	RAN Words
	RAN Objects

6.3 Results

6.3.1 Descriptive statistics and comparisons across grades

Descriptive statistics can be found in Table 6.4 and Table 6.5 with the means and standard deviations for each measure presented for each grade level. Since the English grades of the participants formed a wide range (Grade 3 to 12) there were small sample sizes in some grades. Therefore, the participants were divided into two school-grade groups (A & B for lower grades and high grade respectively). This meant that sample sizes in these two school-grade levels were large enough to analyse variability in the participants' performance on the English measures in the study. Overall, the mean values showed improvements with grade level, consistent with age and educational experience increasing skills, and the standard deviation scores indicated reasonable levels of individual variability. However, there were

exceptions to these general trends in the descriptive data. The Persian vocabulary scores showed improvements between Persian grade levels 3 and 4, but did not show improvements from 2 to 3 or from 4 to 5. It is not clear why this should be the case given the improvements with grade levels in the other measures (e.g., Persian Listening Comprehension), but may be related to the language training/exposure given to the children in this context – vocabulary exposure in immigrant cultures, and/or the teaching provided outside of Iran, may lead to differences in vocabulary development. However, this potential problem with vocabulary will be considered when interpreting results. Additionally, some of the English measures showed evidence of the older group performing relatively similarly to the younger group. These measures were Listening Comprehension, Sound Deletion and Non-word reading Fluency. This could be due to the heterogeneous group recruited for the study in terms of their age, English school grades and socio-economic factor.

Table 6.4. Mean scores and standard deviations (SD) for the Persian measures produced by grades in the study

		RC Cloze	RC Ques	List Comp	Vocab	Sound Del	NW Read Fl	Match Wrd	Wrd Chains	Ortho Choic	RAN Wrd	RAN Obj
Total scores		26	23	40	100	15	NC/Per S	25	50	30	Per Second	Per Second
Grade2	Mean	6.07	4.00	23.55	64.02	10.53	.25	15.64	22.93	12.90	54.74	51.10
	SD	.51	.32	.59	2.27	.57	.02	.81	1.41	.79	3.43	2.67
Grade 3	Mean	9.10	6.13	26.19	61.76	11.41	.35	18.00	25.26	14.45	32.92	45.71
	SD	.68	.65	.94	3.39	.82	.05	.84	1.80	1.27	3.28	3.51
Grade 4	Mean	10.96	8.08	27.65	74.10	12.65	.51	18.61	27.00	16.71	32.98	39.28
	SD	.77	.81	1.15	2.62	1.33	.12	.86	2.30	1.28	3.56	1.98
Grade5	Mean	15.09	11.27	28.45	73.75	14.18	.81	20.16	35.54	23.54	19.68	38.63
	SD	1.81	1.73	2.12	4.1	1.69	.20	2.14	4.24	1.82	1.88	2.61

Key: RC Cloze=reading comprehension Cloze, RC Ques=reading comprehension Questions, List Comp=listening comprehension, Vocab=vocabulary, NW Read Fl=non-word reading fluency, Sound Del=sound deletion, Match Wrd=matching words, Wrd Chains=word chains, Ortho Choic=orthographic choice, RAN Wrd=rapid naming of familiar words, RAN Obj=rapid naming of familiar objects, C/PerS=number correct per Second

Table 6.5. Mean scores and standard deviations (SD) for the English measures produced by grades in the study

		RC Cloze (/28)	RC Ques (/40)	List Comp	Vocab	Sound Del	NW Read Fl	Match Wrd	Wrd Chains	Ortho Choic	RAN Wrd	RAN Obj
Total scores		28	40	38	84	15	NC/ Per M	25	50	30	Per Second	Per Second
Group A	Mean	13.1	18.41	25.88	56.36	12.12	.54	21.48	41.71	21.14	22.26	31.39
	SD	4.67	6.22	4.17	14.51	3.25	.24	5.2	12.53	6.65	13.51	9.20
Group B	Mean	14.56	21.88	25.64	64.29	12	.60	22.54	44.08	24.06	21.85	29.1
	SD	5.17	6.53	4.02	14.63	2.84	.28	3.92	9.40	5.42	26.22	19.34

Key: RC Cloze=reading comprehension Cloze, RC Ques=reading comprehension Questions, List Comp=listening comprehension, Vocab=vocabulary, NW Read Fl=non-word reading fluency, Sound Del=sound deletion, Match Wrd=matching words, Wrd Chains=word chains, Ortho Choic=orthographic choice, RAN Wrd=rapid naming of familiar words, RAN Obj=rapid naming of familiar objects, NC/PerM=number correct per minute

6.3.2 Correlation amongst the measures (Persian and English measures)

To assess the relationship between the text comprehension measures and the other measures used in this study, first-order correlations and partial correlations controlling for age (in months), sex and grade (both Persian and English school levels) were calculated. Tables 6.6 – 6.8 present first-order correlations (lower diagonal) and partial correlations between the measures in the study in Persian and English.

Relationships were found between similar measures as predicted. The two text comprehension measures were significantly related in both languages and for first and partial correlation calculations. Vocabulary and Listening Comprehension measures were also related, though the partial correlation for the Persian measures was not significant – which again may indicate a need for caution in interpretation of the Persian vocabulary measure in this context of testing. The Phonological measure was significantly correlated with the Non-word reading measure in both languages. The correlations among the measures of orthographic processing (i.e., the Matching Words, Word Chains and Orthographic Choice) were found to be significant – again this was true of both languages and correlation calculations. Finally, the measures of speed of processing showed significant relationships in both languages – though that for English was much larger once age, sex and grade were controlled.

Table 6.6. First-order correlations between the two reading comprehension measures and all other measures used in the study

	Persian Measures		English Measures	
	RC Cloze	RC Ques	RC Cloze	RC Ques
RC Ques	.789**		.496**	
List Comp	.576**	.591**	.504**	.568**
Vocab	.391**	.453**	.523**	.609**
NW Read	.691**	.472**	.356**	.186
Sound Del	.377**	.572**	.444**	.421**
Match Wrd	.379**	.385**	.411**	.321**
Wrd Chains	.582**	.509**	.565**	.336**
Ortho Choic	.645**	.619**	.478**	.410**
RAN Wrd	–.508**	–.403**	–.213	–.063
RAN Obj	–.282*	–.219	–.315**	–.105

Key: RC Cloze=reading comprehension Cloze, RC Ques=reading comprehension Questions, List Comp=listening comprehension, Vocab=vocabulary, NW Read=non-word reading, Sound Del=sound deletion, Match Wrd=matching words, Wrd Chains=word chains, Ortho Choic=orthographic choice, RAN Wrd=rapid naming of familiar words, RAN Obj=rapid naming of familiar objects

*$p < .05$. **$p < .01$.

Table 6.7. First-order correlations (lower diagonal) and partial correlations (controlling for age month/form, sex and Persian and English grade) between the Persian measures in the study

	RC Cloze	RC Ques	List Comp	Vocab	Sound Del	NW Read	Match Wrd	Wrd Chains	Ortho Choic	RAN Wrd	RAN Obj
RC Cloze		.715**	.563**	.304*	.381**	.634**	.332*	.475**	.499**	–.203	.039
RC Ques	.789**		.491**	.358**	.370**	.457**	.184	.320*	.394**	–.147	.024
List Comp	.576**	.591**		.233	.259*	.431**	.175	.316*	.414**	–.137	.039
Vocab	.391**	.453**	.359**		.096	.117	.021	–.005	.139	–.095	–.184
Sound Del	.377**	.472**	.320**	.152		.647**	–.107	–.081	–.006	–.260	–.267*
NW Read	.691**	.572**	.522**	.236*	677**		.204	.396**	.285*	–.324*	–.031
Match Wrd	.379**	.385**	.285**	.197	.007	.319**		.475**	.459**	–.176	.090
Wrd Chains	.582**	.509**	.387**	.206	.112	.499**	.497**		.682**	.105	.258
Ortho Choic	.645**	.619**	.452**	.278*	.201	.473**	.502*	.704**		–.082	.187
RAN Wrd	–.508**	–.403**	–.210	–.227*	–.305**	–.482**	–.234*	–.194	–.362**		.493**
RAN Obj	–.282*	–.219	–.017	–.179	–.258*	–.158	–.012	.011	–.041	.563**	

Key: RC Cloze=reading comprehension Cloze, RC Ques=reading comprehension Questions, List Comp=listening comprehension, Vocab=vocabulary, NW Read=non-word reading, Sound Del=sound deletion, Match Wrd=matching words, Wrd Chains=word chains, Ortho Choic=orthographic choice, RAN Wrd=rapid naming of familiar words, RAN Obj=rapid naming of familiar objects

*p < .05. **p <.01.

Table 6.8. First-order correlations (lower diagonal) and partial correlations (controlling for age month/form, sex and Persian and English grade) between the English measures in the study

	RC Cloze	RC Ques	List Comp	Vocab	Sound Del	NW Read	Match Wrd	Wrd Chains	Ortho Choic	RAN Wrd	RAN Obj
RC Cloze		.565**	.633**	.565*	.286	.326*	.382*	.544**	.481**	–.204	–.406**
RC Ques	.496**		.491**	.581**	.223	.347*	.308*	.329*	.391**	–.041	–.009
List Comp	.504**	.568**		.598**	.226	.322*	.384*	.455**	.549**	–.308*	–.413**
Vocab	.523**	.609**	.638**		.348*	.410**	.458**	.446**	.454**	–.442**	–.452**
Sound Del	.356**	.186	.343**	.360*		.668**	.240	.353*	.293	–.456**	–.408**
NW Read	.444**	.421**	.383**	.481**	.549**		.280	.393**	.461**	–.593**	–.443**
Match Wrd	.411**	.321**	.434**	.513*	.293**	.373**		.849**	.757**	–..357*	–.211
Wrd Chains	.565**	.336**	.579**	–.544**	.419**	.460**	.817**		.859**	–.491**	–.411**
Ortho Choic	.478**	.410**	.546**	–.540**	.347**	.507**	.723**	.543**		–.505**	–.391**
RAN Wrd	–.213	–.063	–.160	–.256*	.241*	–.302**	–.207	–.278*	–.317**		.733**
RAN Obj	–.315**	–.105	–.317**	–.369**	.227*	–.382**	–.224*	–.360**	–.340**	.262*	

Key: RC Cloze=reading comprehension Cloze, RC Ques=reading comprehension Questions, List Comp=listening comprehension, Vocab=vocabulary, NW Read=non-word reading, Sound Del=sound deletion, Match Wrd=matching words, Wrd Chains=word chains, Ortho Choic=orthographic choice, RAN Wrd=rapid naming of familiar words, RAN Obj=rapid naming of familiar objects

*p < .05. **p <.01.

6.4 Examining the Persian model of reading

The Persian model of reading, as presented in Chapter 5, suggests that language related skills, phonological/decoding skills, orthographic skills and speed of processing are the four major sets of predictors of Persian reading comprehension with the latter (speed of processing being age/grade related). To examine the model, initially, whole-cohort stepwise regression analyses were performed on the Persian measures to assess the level of prediction provided by combinations of measures within the bilingual (Persian-English) cohort recruited for this study. Consistent with the Persian model of reading, and similar models of reading derived from English such as the Simple View of Reading (SVR), Persian text comprehension measures were used as dependant variables (DV) controlling for age (in months), sex and the Persian grade of participant. The predictor variables were then entered in the model. All measures in the Persian language were used in this analysis: Listening Comprehension, Vocabulary, Sound Deletion, Non-word Reading Fluency, Matching Words, Word Chains, Orthographic Choice, RAN Words and Objects. Tables 6.9 and 6.10 present the results for the Reading Comprehension Cloze and Questions measures, respectively. The results were largely consistent with the Persian model of reading and the SVR in confirming that text comprehension in Persian can be reasonably well predicted by word-level skills as well as understanding-level skills.

Table 6.9. Results of a stepwise regression analysis to investigate predictors of Persian reading comprehension (Cloze)

Steps	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
Controlled	.455	.455	F=16.98, *p* <.001	Sex	.010
				Age	–.062
				Grade	.329
1	.673	.218	F=39.91, *p* <.001	Non-word Fluency	.361
2	.730	.057	F=12.43, *p*<.001	Listening Comprehension	.186
3	.755	.025	F=5.92, *p=.018*	Orthographic Choice	.202
4	.778	.023	F=5.96, *p*=.018	Vocabulary	.173

Table 6.10. Results of a stepwise regression analysis to investigate predictors of Persian reading comprehension (Questions)

Steps	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
Controlled	.415	.415	F=14.43,*p* <.001	Sex	.051
				Age	–.068
				Grade	.422
1	.544	.129	F=16.96, *p* <.001	Listening Comprehension	.305
2	.596	.051	F=7.51, *p*=.008	Vocabulary	.215
3	.628	.032	F=4.99, *p*=.029	Sound Deletion	.201

The stepwise regression analyses were then followed by whole-cohort hierarchical regression analyses to assess the level of prediction provided by combinations of measures in the study.

Similar to the stepwise regression models, both text comprehension measures were used as DV (see table 6.11 and 6.12 for the Comprehension Cloze and Questions, respectively), with the remaining variables (understanding-level and word-level skills) entered in a prescribed order after participant control variables (age in months, sex and Persian grade). The order of entry of the predictor variables was first language-related measures (i.e., the Listening Comprehension and Vocabulary measures), then phonological/decoding skills (i.e., the Sound Deletion and Non-word Reading Fluency measures), orthographical skills (i.e., the Matching Words, Word Chains and Orthographic Choice measures) and finally speed of processing (i.e., the RAN Words and RAN Objects measures).

Table 6.11. Results of a hierarchical regression analysis to investigate predictors of Persian reading comprehension (Cloze)

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.455	.455	F=16.98 *p*<.001	Sex	.022
					Age	–.074
					Grade	.351
2	Language related Skills	.654	.199	F=16.92 *p*<.001	Listening Comp.	.183
					Vocabulary	.181
3	Phonological/Decoding Skills	.756	.102	F=11.91 *p*<.001	Sound Deletion	.061
					Non-word Fluency	.301
4	Orthographic Skills	.782	.027	F=2.19 *p*=.099	Matching Words	.069
					Word Chains	.048
					Orthographic Choice	.144
5	Speed of Processing	.784	.002	F= .26 *p*=.774	RAN Words	–.006
					RAN Objects	.058

Table 6.12. Results of a hierarchical regression analysis to investigate predictors of Persian reading comprehension (Questions)

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.415	.415	F=14.43 *p*<.001	Sex	.063
					Age	–.056
					Grade	.331
2	Language related Skills	.596	.180	F=13.15 *p*<.001	Listening Comp.	.323
					Vocabulary	.204
3	Phonological/Decoding Skills	.631	.036	F=2.74 *p*=.073	Sound Deletion	.276
					Non-word Fluency	–.093
4	Orthographic Skills	.653	.022	F=1.15 *p*=.336	Matching Words	.042
					Word Chains	.134
					Orthographic Choice	.079
5	Speed of Processing	.655	.002	F= .15 *p*=.859	RAN Words	–.076
					RAN Objects	.043

The results indicated a similar pattern of predictors across the two reading comprehension measures. The combined model predicted roughly about 70% of the variability in both Reading Comprehension measures (78% in Cloze and 65% in Questions) in Persian; which was very similar to the results obtained in Study 1 with monolingual Persian children. Each of the areas entered into these analyses seemed to predict some independent variability consistent with that found in similar analyses performed on Study 1 data. The exception was the speed of processing measures, which again in these general cohort analyses did not seem to predict independent variability. One of the main differences between the monolingual data and the current data was that the language skills measures seemed to be more predictive of

reading comprehension levels among the bilingual participants in the current study than found with the monolingual Persian children in Study 1. Language skills (listening comprehension and vocabulary) predict about 20% of the variation in the model for the bilingual cohort, whereas it was closer to 10% in the comparable analyses in the previous chapter.

Similar hierarchical regression analyses were performed focusing on each grade (grade 2 to 5) to investigate the trend of predictors from fairly early stages of literacy skills (grade 2) to relatively experienced readers (grade 5). Due to the smaller sample size, the cohort was divided into two groups: lower grades (Grade 2 & 3) and higher grades (Grade 4 & 5). Consistent with the whole-cohort hierarchical regression models both text comprehension measures were used as DV, with the remaining variables (understanding-level and word-level skills) entered in a prescribed order after participant control variables (age in months, sex and Persian grade): language-related measures (i.e., the Listening Comprehension and Vocabulary measures), phonological/decoding skills (i.e., the Sound Deletion and Non-word Reading Fluency measures), orthographical skills (i.e., the Matching Words, Word Chains and Orthographic Choice measures), speed of processing (i.e., the RAN Words and RAN Objects measures). Tables 6.13 – 6.16 present the results of lower grades (grade 2 & 3) and higher grades (grade 4 & 5) for the Comprehension Cloze and Questions, respectively.

Table 6.13. Results of a hierarchical regression analysis to investigate predictors of Persian reading comprehension (Cloze) for Grade 2 & 3

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex , Age and Grade	.192	.192	F=3.16 *p*=.035	Sex	.011
					Age	–.01
					Grade	.317
2	Language related Skills	..302	.110	F=2.98 *p*=.063	Listening Comp.	.203
					Vocabulary	.091
3	Phonological/Decoding Skills	.420	.118	F=3.67 *p*=.035	Sound Deletion	.177
					Non-word Fluency	.291
4	Orthographic Skills	.471	.051	F=1.05 *p*=.383	Matching Words	.205
					Word Chains	–.036
					Orthographic Choice	.122
5	Speed of Processing	.490	.020	F=.605 *p*=.552	RAN Words	.169
					RAN Objects	.057

Table 6.14. Results of a hierarchical regression analysis to investigate predictors of Persian reading comprehension (Cloze) for Grade 4 & 5

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex , Age and Grade	.128	.128	F=.82 *p*=.496	Sex	.067
					Age	–.108
					Grade	.275
2	Language related Skills	.723	.595	F=16.09 *p*<.001	Listening Comp.	.322
					Vocabulary	.370
3	Phonological/Decoding Skills	.894	.171	F=10.47 *p*=.002	Sound Deletion	–.412
					Non-word Fluency	.737
4	Orthographic Skills	.904	.010	F=.349 *p*=.791	Matching Words	–.131
					Word Chains	–.007
					Orthographic Choice	.077
5	Speed of Processing	.908	.004	F=.195 *p*=.826	RAN Words	–.098
					RAN Objects	.000

Table 6.15. Results of a hierarchical regression analysis to investigate predictors of Persian reading comprehension (Questions) for Grade 2 & 3

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex , Age and Grade	.140	.140	F=2.11 *p*=.114	Sex	.019
					Age	.039
					Grade	.353
2	Language related Skills	.148	.008	F=0.174 *p*=.841	Listening Comp.	–.005
					Vocabulary	.144
3	Phonological/Decoding Skills	.407	.259	F=7.65 *p*=.002	Sound Deletion	.461
					Non-word Fluency	.280
4	Orthographic Skills	.449	.042	F=.808 *p*=.499	Matching Words	.259
					Word Chains	–.183
					Orthographic Choice	.090
5	Speed of Processing	.473	.024	F=.686 *p*=.511	RAN Words	.206
					RAN Objects	.042

Table 6.16. Results of a hierarchical regression analysis to investigate predictors of Persian reading comprehension (Questions) for Grade 4 & 5

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex , Age and Grade	.107	.107	F=.71 *p*=.554	Sex	.170
					Age	–.136
					Grade	.148
2	Language related Skills	.731	.624	F=18.57 *p*<.001	Listening Comp.	.421
					Vocabulary	.500
3	Phonological/Decoding Skills	.768	.037	F=1.11 *p*=.354	Sound Deletion	–.129
					Non-word Fluency	–.110
4	Orthographic Skills	.879	.111	F=3.38 *p*=.058	Matching Words	–.332
					Word Chains	.337
					Orthographic Choice	.108
5	Speed of Processing	.891	.012	F=.48 *p*=.631	RAN Words	–.116
					RAN Objects	.156

Overall, the analyses suggested that language related skills and decoding skills predict a reasonable amount of variability in both Reading Comprehension measures across grades. However, the findings indicate that the level of prediction provided by the language skills increases across the grade levels analysed, suggesting that older readers may rely more on their linguistic comprehension to understand the text. Linguistic comprehension also showed higher levels of prediction in the Comprehension Questions measure for the older cohort, potentially arguing for a need for increased understanding skills to accomplish this task to more mature levels of ability – note that the reverse was true for the younger grades, where Language related skills were only significant in the Cloze measure. Interestingly, it was

vocabulary as much as Listening comprehension that showed growth in prediction of text reading comprehension from less to more experienced readers, suggesting that vocabulary knowledge may be essential for experienced readers to understand written texts in L2.

In addition to understanding-level skills, word-level skills were found to be good predictors in this study. Phonological/decoding skills proved to be reasonable predictors for both reading comprehension measures across grades. For the younger grades (2 and 3), sound deletion was a good predictor of comprehension variability in both tasks. For the higher grades (4 and 5), decoding skills (non-word reading) seemed to be a good predictor of variability in the Cloze procedure, whereas they were much less predictive of variability in the Questions comprehension task. These findings are potentially consistent with the Cloze procedure being more reliant on word-level processes than tasks that require answering questions about passages of text.

Orthographic skills also showed relatively reasonable levels of prediction across grades – about or approaching 10% – although this seemed to be influenced by the level of prediction provided by the Decoding measure in the analysis of the Cloze data in the older cohort (Table 6.14). However, the speed of processing measures proved to show non-significant levels of variability explained across both comprehension measures and both grade levels, a finding partially consistent with interpretations from Study 1 about the relatively low level of influence of speed of processing measures in Persian reading comprehension – although it may be that the influence of this factor will increase in higher grade levels.

To further assess unique contributions to Persian text comprehension, an additional set of whole-cohort regression analyses were conducted, this time with the Non-word Reading Fluency measure separated from the phonological skills measures and entered as the last step. These alternative entry sequences were performed to determine unique contributions to

Persian reading comprehension of the underlying cognitive-linguistic skills. Tables 6.17 and 6.18 show the results for the Comprehension Cloze and Questions, respectively.

Table 6.17. Results of a hierarchical regression analysis to investigate predictors of reading Persian comprehension (Cloze) treating the Non-word Reading Fluency separately

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.455	.455	F=16.98 p<.001	Sex	.022
					Age	–.074
					Grade	.351
2	Language related Skills	.654	.199	F=16.92 p<.001	Listening Comp.	.183
					Vocabulary	.181
3	Phonologic Skills	.683	.029	F=5.30, p=.025	Sound Deletion	.061
4	Orthographic Skills	.753	.070	F=5.22 p=.003	Matching Words	.069
					Word Chains	.048
					Orthographic Choice	.144
5	Speed of Processing	.762	.009	F= .98 p=.379	RAN Words	–.006
					RAN Objects	.058
6	Decoding Skills	.784	.023	F=5.43, p=.024	Non-word Fluency	.301

Table 6.18. Results of a hierarchical regression analysis to investigate predictors of reading Persian comprehension (Questions) treating the Non-word Reading Fluency separately

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.415	.415	F=14.43 p<.001	Sex	.063
					Age	–.056
					Grade	.331
2	Language related Skills	.596	.180	F=13.15 p<.001	Listening Comp.	.232
					Vocabulary	.204
3	Phonologic Skills	.628	.032	F=4.99, p=.029	Sound Deletion	.276
4	Orthographical Skills	.653	.025	F=1.32 p<.274	Matching Words	.042
					Word Chains	.134
					Orthographic Choice	.079
5	Speed of Processing	.654	.001	F= .074 p=.929	RAN Words	–.076
					RAN Objects	.043
6	Decoding Skills	.655	.002	F=.236, p=.629	Non-word Fluency	–.093

The results indicated a similar pattern of predictors across the two reading comprehension measures, and treating Non-word Fluency separately did not add to interpretations of the model substantially. Both phonological and orthographic measures showed significant levels of prediction of variability in these analyses. Though, interestingly, the orthographic skills level of prediction of the Comprehension Questions task remained fairly consistent across analyses, which may suggest that the influence of orthographic skills on this comprehension task is not simply due to relationships with word identification processes. Speed of processing remained as a non-significant predictor of text reading comprehension in Persian.

6.4.1 Predictors of decoding skills in Persian

To assess the level of prediction provided by combinations of measures of word-level skills in the study, whole-cohort hierarchical regression analyses were performed. The Non-Word Reading Fluency measure representing decoding skills was used as DV with the remaining variables entered in a prescribed order: first age (in months), sex and grade of child were entered to control for effects of these variables, then the predictor variables were entered, starting with the phonological skills measure (the Sound Deletion measure), the orthographical skills measures (the Matching Words, Word Chains, and Orthographic Choice measures), the speed of processing measures (the RAN Words and RAN Objects), and finally the linguistic comprehension measures (the Listening Comprehension and Vocabulary) (see table 6.19).

Table 6.19. Results of a regression analysis to investigate predictors of Persian decoding

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.239	.239	F=7.02 *p*<.001	Sex	.206
					Age	.018
					Grade	.020
2	Phonological Skills	.631	.392	F=70.01 *p*<.001	Sound Deletion	.620
3	Orthographic Skills	.754	.123	F=10.54 *p*<.001	Matching Words	.037
					Word Chains	.362
					Orthographic Choice	–.093
4	Speed of Processing	.805	.051	F= 7.95, *p*=.001	RAN Words	–.312
					RAN Objects	.229
5	Language related Skills	.812	.007	F=1.05 *p*=.356	Listening Comp.	.091
					Vocabulary	.039

The results indicated that all variables entered into this analysis, except the linguistic comprehension measures, predict independent variability, with the best predictor being the phonological skills measure. Bilingual children's phonological skills showed a substantial level of prediction in this model (40%) and the model could explain 81% of the variability. To further analyze the prediction levels across grades, the same analyses were performed on lower grades (grade 2 & 3) and higher ones (grade 4 & 5) (see Tables 6.20 & 6.21).

Table 6.20. Results of a regression analysis to investigate predictors of Persian decoding for grade 2 & 3

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Age, and Sex	.046	.046	F=.70 *p*=.553	Sex	.039
					Age	–.044
					Grade	–.236
2	Phonological Skills	.117	.071	F=3.46 *p*=.07	Sound Deletion	.345
3	Orthographic Skills	.462	.345	F=8.54 *p*<.001	Matching Words	.348
					Word Chains	.019
					Orthographic Choice	.261
4	Speed of Processing	.578	.116	F= 5.22 *p*=.01	RAN Words	–.435
					RAN Objects	–.015
5	Language related Skills	.619	.041	F=1.94 *p*=.158	Listening Comp.	.205
					Vocabulary	–.116

Table 6.21. Results of a regression analysis to investigate predictors of Persian decoding for grade 4 & 5

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Age, and Sex	.138	.138	F=1.01 *p*=.408	Sex	.100
					Age	.005
					Grade	–.138
2	Phonological Skills	.788	.650	F=52.21 *p*<.001	Sound Deletion	.755
3	Orthographic Skills	.874	.085	F=3.38 *p*<.046	Matching Words	.138
					Word Chains	.201
					Orthographic Choice	.099
4	Speed of Processing	.923	.049	F= 4.16 *p*=.04	RAN Words	–.087
					RAN Objects	.300
5	Language related Skills	.926	.003	F=.19 *p*=.828	Listening Comp.	–.092
					Vocabulary	–.023

The results suggest that phonological skills tend to be better predictors in the higher grades, whereas orthographic skills seem to be the better predictor in the lower grades. This finding was in contrast to the finding reported in Study 1 where phonological and orthographic skills tended to be better predictors in the lower grades. This may suggest that higher graders in L2 lag behind their monolingual counterparts in the development of literacy skills: the higher graders in the current study showing that they may still tend to use skills that focus on parts of the word. However, clearly phonological, orthographic and speeded access processes seem essential for decoding fluency.

6.4.2 Persian model of reading

Overall, the findings indicated that Persian reading comprehension levels were predicted by understanding-level and word-level skills, with word-level skills being predicted by phonological skills, orthographic skills and speeded access. In addition, orthographic skills seem to show predictions of text reading comprehension in Persian that are somewhat independent of the influence of word-level decoding skills – an interpretation consistent across both monolingual and bilingual data sets. In the case of speed of processing, the independent influence on comprehension found in the monolingual data did not approach significant levels across the grades tested. However, the bilingual higher graders may not have reached equivalent levels of Persian literacy-related skills to the monolingual cohort tested in Study 1; therefore, further research is necessary to confirm or disconfirm the influence of speed of processing. Overall, though, the findings from the current study seem to further test the Persian model of reading presented in Chapter 5 of this thesis (Fig. 5.1).

6.5 Intra-language influences (Does L1 predict L2 over L2 measures?)

To investigate whether ability in L1 (English) can add to the level of prediction of text reading comprehension in L2 (Persian) over and above cognitive-linguistic skills in L2, a further series of hierarchical regression analyses were conducted. These involved using one of the reading comprehension measures in Persian as the dependent variable, controlling for sex, age (in months), Persian and English school grade of the participants, then entering measures of analogous skills in the two languages with the Persian measures preceding the English measures: e.g., the Persian language skills followed by those for English. The analyses were conducted contrasting language related skills, phonological/decoding skills, orthographic skills and speed of processing. Persian language measures were always entered before the English measures to determine if the latter increased the level of variability

predicted. Analyses indicated that the level of prediction of Persian reading comprehension was not improved significantly by the addition of L1 (English language) measures except listening comprehension (English) which was found explaining variation of the Reading Comprehension Questions in Persian (β =.24, t(2.34), p=.02) above the same measures in L2 (i.e., Persian). Considering the older age range of the participants, this finding can be interpreted as the importance of listening comprehension as a strong predictor of reading comprehension particularly for the Questions measure. Appendix D presents the analyses conducted for this section (with detailed analysis of the language related skills for the Reading Comprehension Questions).

6.6 Discussion

The primary objective of this study was to examine the underlying cognitive-linguistic skills proposed by the model of Persian reading comprehension discussed earlier in the thesis (Chapter 5) and to determine whether this model would be applicable to bilingual Persian-English learners. The Persian measures used in this study were the same measures which proved to be reasonable indicators of Persian reading comprehension in Study 1. Again Persian grades 2 to 5 were considered to assess cross-grade effects. The findings indicated that, consistent with the findings from Study 1, Persian reading comprehension levels of bilingual Persian-English speakers were predicted by measures of linguistic competence and word decoding (consistent with a simple view of reading), with the latter being predicted by phonological and orthographic processing skills. The addition of L1 skills did not add to the level of prediction provided by the Persian measures.

However, there were some findings that diverged from those in Study 1. Persian language related skills in the bilingual data seemed to be more predictive of reading comprehension than found in the monolingual Persian data. This may suggest that language ability,

particularly listening comprehension, is essential for the bilingual cohort to understand the text that they read in their L2. However, another explanation might be that the average age of the participants in this study was higher than the monolingual cohort tested in the previous study. Previous research (e.g., Bell & Perfetti, 1994; Rayner et al., 2001) has suggested that older, more experienced readers show more effects of listening comprehension compared to word-level decoding skills on reading comprehension than found in younger cohorts.

Consistent with the Persian model developed in Study 1, orthographic measures predicted literacy skills from an early age, arguing for the possibility that Persian orthographic knowledge is an important early skill for an individual to read accurately/fluently and comprehend written text. However, in contrast to the monolingual data, analyses across grades indicated that lower grade children tend to rely more on orthographic knowledge to process decoding whereas for older children there was an increasing trend for phonological skills to be influential: in the Persian monolingual data, both skills areas seem to be predictive across grade levels. In contrast, speed of processing showed evidence of growing as a predictor of reading comprehension levels across the grade levels studied in the Persian monolingual data, but this trend was not evident in the bilingual findings where speed of processing seemed to show little influence on comprehension levels. However, in both data sets, speed influenced word decoding skills.

Despite these differences, overall, the findings confirmed the Persian reading comprehension model proposed in Chapter 5 of this thesis. This will be discussed further following the next data chapter.

Chapter 7

Study 3

Persian Reading Comprehension Deficit

7.1 Introduction

This chapter introduces further analyses on the Persian monolingual data presented in Chapter 5 of this thesis. These analyses aimed to investigate influences of word-level and understanding-level processes by contrasting the performance of average comprehenders with those who showed deficits in text reading comprehension. This provided an opportunity to examine the potential for the Persian model of reading proposed in this thesis (Chapter 5 – Figure 5.1) to inform procedures for identifying underlying cognitive deficits of those with text comprehension problems.

Measures of the Non-word Reading Scores, Non-word Reading Fluency, Sound Deletion, Matching Words, Chain Words 1, and Orthographic Choice were used as indicators of word-level processes and measures of the Listening Comprehension and Vocabulary were used as indicators of understanding-level processes of oral language skills. Two measures of Rapid Automatized Naming (RAN), RAN-Words and RAN-Objects, were also used as indicators of the speed at which the child could access to phonological representation of words and the speed of general cognitive processing. Two measures of the reading comprehension, the Cloze and Questions procedures, were used in the analyses. (See chapter 4 for a review on developing the measures used in the study – appendix C also presents the full version of the measures.) Poor performers, those within the bottom 15% of the cohort, on the two text

reading comprehension measures (i.e., Cloze and Questions) were selected. The performance of these individuals on the study measures was contrasted with that of children who showed normal expected level of performance on the two reading comprehension measures.

7.2 Methodology

7.2.1 Participants

The 232 Persian primary school children from grade 2 to 5 attending mainstream Iranian school in Tehran described in Chapter 5 were considered. Of these, only those who performed the comprehension measures were selected; hence the participants (N=20) who did not perform the comprehension measures due to absenteeism were deselected from analyses. In addition, children (N=4) with recorded/recognized problems were coded and deselected from analyses: (i) two children who used hearing aids; one of who received additional lessons after school hours to be assisted with subjects like science and maths; (ii) one child who had attention problems, according to the classroom teacher, which made him a low achiever; and (iii) one child who was recognized with relatively serious problems of articulation whilst being tested. Finally, two children were deselected since they did not perform the Non-word Reading task due to absenteeism. This left 206 children from the original sample. Table 7.1 provides a breakdown of the number of the participants in each grade with range and mean age in months.

Table 7.1. Demographics – number of participants (average and poor comprehenders) along with the range and mean age per grade

average comprehenders						
school grade of child		2	3	4	5	Total
sex of child	male	20	21	17	24	82
	female	20	25	26	20	91
age in months	mean	93.75	107.08	118.37	129.45	112.49
	range	89–100	101–113	110–124	125–136	89–136
poor comprehenders						
school grade of child		2	3	4	5	Total
sex of child	male	5	6	6	5	22
	female	2	1	4	4	11
age in months	mean	95.57	103.71	118.20	128.33	113.09
	range	92–100	101–107	112–127	124–138	92–138

The participants of each grade were ranked based on their performance on the two text reading comprehension measures (i.e., Cloze and Questions); with lower ranks indicative of poorer performance. Children who performed within the bottom 15% in both text reading comprehension measures were coded as poor comprehenders (i.e., those who performed well on one of the text reading measures but poorly on the other were not considered as poor comprehenders) – see Table 7.1. To investigate the underlying skills (i.e., verbal skills, phonological skills and/or orthographic skills) which may account for poor performance on text reading comprehension in Persian, these poor comprehenders were divided into two groups. Those who preformed one Standard Deviation (SD) below the mean on either the Non-word Reading Score or the Non-word Reading Fluency measure were considered as

poor decoders. The rest were considered as average decoders. Table 7.2 presents information on the poor comprehenders who were either average decoders or poor decoders.

Table 7.2. Demographics – Number of poor comprehenders (average decoders and poor decoders), together with the range and mean age in months per grade

average decoders						
school grade of child		2	3	4	5	Total
sex of child	male	2	6	2	3	13
	female	1	0	2	3	6
age in months	mean	95.33	103.16	117.25	127.66	112.36
	range	94–97	101–107	114–122	124–138	94–38
poor decoders						
school grade of child		2	3	4	5	Total
sex of child	male	3	0	4	2	9
	female	1	1	2	1	5
age in months	mean	95.75	107	118.83	129.66	113.71
	range	92–100	____	112–127	125–133	92–133

7.2.2 Measures

The following provides a brief summary of the measures used in this study (see Chapter 4, for a review on developing measures). The measures were: the Reading Comprehension Questions (reading passages followed by questions about the text) and the Reading Comprehension Cloze (sentence completion) tasks, which were considered as indicative of text reading comprehension ability; Listening Comprehension (answering comprehension

questions about orally presented passages) and Vocabulary (selecting a picture that best illustrates the meaning of an orally presented stimulus word), considered as indicative of oral language skills; Sound Deletion (deleting a sound from a spoken word: 'cat without the /c/ sound' – English examples are provided for ease of understanding, though all tasks were presented in Persian) and Non-word Reading (naming a novel letter string: 'spoog'), considered as indicative of phonological-based word decoding skills; Matching Words (saying whether pairs of letter strings were the same or different, where the different pairs differed by one letter/grapheme: 'sand send'), Chain Words (indicating random real words in a text where the spaces between words have been removed: 'thehelptimeafterman') and Orthographic Choice (selecting the correct spelling amongst letter strings that were real words or novel letter strings that sounded like real words if translated using spelling-sound conversion rules: e.g., 'monk munk'), considered as indicative of orthographic knowledge; and the RAN Words and Objects (naming familiar words or drawings of objects presented on a card as fast but accurately as possible) tasks, which were considered as indicative of the speed at which the child could access to phonological representation of words and objects or the speed of general cognitive processing. As discussed in Study 1, these measures proved to be inter-related and led to the development of the Persian reading comprehension model.

7.3 Results

Analyses of Covariance (ANCOVAs) were performed to assess differences between the comprehension level groups (average comprehenders and poor comprehenders) on the measures in the study. In each case, the covariate was school grade of child. Tables 7.3 to 7.6 present the results of these covariance analyses and the performance per grade of average comprehenders and poor comprehenders on the measures.

Table 7.3. Covariance analyses (covariate: school grade of child) along with the performance of average comprehenders and poor comprehenders on the language related skills per grade

				average comprehenders			poor comprehenders		
Measures	F	*p* value	Grade	M	N	SD	M	N	SD
Listening Comprehension	10.86 (df=1, 197)	.001	2	29.20	39	5.53	26.16	6	6.94
			3	32.36	46	3.84	28.14	7	3.07
			4	33.74	43	3.71	32.90	10	1.66
			5	36.09	43	2.26	33.37	8	4.2
			Total	32.92	171	4.62	30.64	31	4.90
Vocabulary	2.00 (df=1, 197)	.158	2	69.32	40	9.28	68.85	7	9.78
			3	70.80	45	8.26	68.71	7	9.14
			4	76.97	41	5.41	76.20	10	5.30
			5	82.92	41	5.88	78.00	9	7.38
			Total	74.94	167	9.09	73.54	33	8.53

Note. M=mean, N=number of the participants, SD=standard deviation

Table 7.4. Covariance analyses (covariate: school grade of child) along with the performance of average comprehenders and poor comprehenders on phonological/ decoding skills per grade

				average comprehenders			poor comprehenders		
Measures	F	*p* value	Grade	M	N	SD	M	N	SD
Non-word Reading Score	12.08 (df=1, 197)	.001	2	27.40	40	2.89	25.71	7	2.87
			3	28.57	45	2.13	29.00	7	1.00
			4	28.46	41	1.70	25.30	10	3.77
			5	28.97	41	1.38	27.88	9	3.14
			Total	28.36	167	2.16	26.87	33	3.24
Non-word reading Fluency	8.85 (df=1, 197)	.003	2	.41	40	.13	.35	7	.15
			3	.59	45	.18	.49	7	.089
			4	.62	41	.17	.44	10	.19
			5	.76	41	.22	.67	9	.44
			Total	.59	167	.21	.49	33	.28
Sound Deletion	11.82 (df=1, 199)	.001	2	12.78	38	2.30	11.50	6	3.27
			3	13.08	46	2.34	10.85	7	2.54
			4	13.62	43	1.46	12.50	10	2.67
			5	13.90	44	1.78	12.7	8	2.43
			Total	13.36	171	2.03	12.00	31	2.68

Note. M=mean, N=number of the participants, SD=standard deviation

Table 7.5. Covariance analyses (covariate: school grade of child) along with the performance of average comprehenders and poor comprehenders on orthographic skills per grade

				average comprehenders			poor comprehenders		
Measures	F	*p* value	Grade	M	N	SD	M	N	SD
Matching Words	14.01 (df=1, 196)	.001	2	12.72	40	4.15	7.83	6	3.25
			3	19.28	45	4.40	13.28	7	5.34
			4	20.07	41	4.69	17.60	10	5.75
			5	21.74	43	4.1	20.71	7	4.46
			Total	18.55	169	5.47	15.36	30	6.59
Word Chains 1	7.34 (df=1, 195)	.007	2	22.52	40	11.31	13.80	5	8.43
			3	37.02	45	11.81	36.00	7	13.34
			4	41.25	40	8.15	37.90	10	5.89
			5	45.85	42	4.88	36.55	9	8.90
			Total	36.78	167	12.77	33.19	31	12.32
Orthographic Choice	25.99 (df=1, 191)	.001	2	14.10	40	5.04	7.50	6	2.58
			3	17.86	46	6.68	8.66	6	2.73
			4	25.97	42	5.53	21.90	10	5.19
			5	27.73	42	4.21	22.42	7	5.02
			Total	21.42	170	7.80	16.31	29	8.14

Note. M=mean, N=number of the participants, SD=standard deviation

Table 7.6. Covariance analyses (covariate: school grade of child) along with the performance of average comprehenders and poor comprehenders on measures of speeded access per grade

				average comprehenders			poor comprehenders		
Measures	F	*p* value	Grade	M	N	SD	M	N	SD
RAN Words	18.67 (df=1, 197)	.001	2	29.22	40	10.40	41.27	7	23.23
			3	23.04	45	9.41	28.38	7	6.36
			4	18.98	41	4.08	25.90	10	8.91
			5	17.46	41	3.24	21.81	9	5.77
			Total	22.15	167	8.69	28.57	33	13.77
RAN Objects	2.28 (df=1, 197)	.133	2	40.18	40	11.00	37.61	7	6.31
			3	33.75	45	7.06	35.47	7	6.38
			4	32.49	41	7.48	35.54	10	6.24
			5	30.40	41	5.06	35.77	9	6.38
			Total	34.16	167	8.62	36.03	33	6.08

Note. M=mean, N=number of the participants, SD=standard deviation

The ANCOVA results contrasting the average comprehenders and the poor comprehenders (Tables 7.3 – 7.6) highlighted differences between the two groups in terms of their performance. The two groups differed significantly in all measures of the study except Vocabulary and RAN Objects.

A second series of ANCOVA were then undertaken, again controlling for school grade of child, which contrasted the performance on the study measures of three groups: average comprehenders, poor comprehenders with difficulties in decoding skills (i.e., scores equal to or below one standard deviation from the mean for the decoding measures) and poor

comprehenders with average to good decoding skills (i.e., scores on the non-word reading measure that were above one standard deviation below the mean). The results for these analyses of covariance can be found in Table 7.7.

Table 7.7. Covariance analyses (covariate: school grade of child) of the Average Comprehenders, Poor Comprehenders-Average Decoders, and Poor Comprehenders-Poor Decoders on the measures of the study

Measures	F	*df* value	*p* value
Listening Comprehension	5.36	2, 198	.004
Vocabulary	1.07	2, 196	.342
Non-word Reading Score	18.97	2, 196	.000
Non-Word Reading Fluency	15.86	2, 196	.000
Sound Deletion	9.02	2, 198	.000
Matching Words	4.40	2, 194	.013
Word Chains1	6.01	2, 195	.003
Orthographic Choice	13.76	2, 195	.000
RAN Words	17.34	2, 196	.000
RAN Objects	1.30	2, 196	.273

Table 7.7 also indicated an effect of group on all measures except the Vocabulary and RAN Objects, as expected based on the first set of post-hoc testing. A final series of ANCOVA were then performed to contrast each poor comprehension group with the average comprehenders. Again, the covariate was school grade of child. The ANCOVA compared: (i) the average comprehenders and the poor comprehenders with average level or above decoding skills (presented in Table 7.8), and (ii) the average comprehenders and the poor

comprhenders who showed difficulties in their decoding skills (presented in Table 7.9). The aim of these analyses was to look for areas of deficit in the underlying cognitive skills that may lead to the potentially two different types of reading comprehension difficulties (i.e., those due to word decoding problems and those not due to language deficits, as predicted by the simple view) across grades tested. (Tables 7.10 – 7.14 present the performance of each group on all measures of the study with the mean scores (M), standard deviations (SD) and the number of the individuals (N) in each grade.)

Table 7.8. Covariance analyses (covariate: school grade of child) of the performance of the Average Comprehenders versus Poor Comprehenders-Average Decoders, on the measures of the study

Measures	F	*df* value	*p* value
Listening Comprehension	8.81	1, 185	.003
Vocabulary	.78	1, 183	.376
Non-word Reading Score	.02	1, 183	.847
Non-Word Reading Fluency	.15	1, 183	.692
Sound Deletion	1.97	1, 187	.162
Matching Words	13.25	1, 182	.000
Word Chains 1	1.90	1, 182	.169
Orthographic Choice	20.99	1, 182	.000
RAN Words	1.56	1, 183	.212
RAN Objects	.72	1, 183	.396

Table 7.9. Covariance analyses (covariate: school grade of child) of the performance of the Average Comprehenders versus Poor Comprehenders-Poor Decoders on the measures of the study

Measures	F	*df* value	*p* value
Listening Comprehension	3.35	1, 182	.069
Vocabulary	1.61	1, 178	.205
Non-word Reading Score	35.69	1, 178	.000
Non-Word Reading Fluency	37.22	1, 178	.000
Sound Deletion	17.32	1, 180	.000
Matching Words	3.36	1, 180	.068
Word Chains 1	7.79	1, 177	.006
Orthographic Choice	8.00	1, 181	.005
RAN Words	32.16	1, 178	.000
RAN Objects	2.03	1, 178	.155

Table 7.10. Performance of each group on the measures of reading comprehension with the mean scores (M), standard deviations (SD) and the number of the individuals in each grade (N)

					poor comprehenders					
		average comprehenders			average decoders			poor decoders		
Measures	Grade	M	N	SD	M	N	SD	M	N	SD
Reading Comprehension Cloze	2	8.37	40	3.83	5.00	3	1.73	6.5	4	3.87
	3	13.54	46	4.74	8.50	6	3.01	3.00	1	–
	4	17.78	42	4.05	13.25	4	2.06	10.16	6	4.26
	5	19.86	43	5.00	14.00	6	7.04	9.33	3	2.51
	Total	14.96	171	6.18	10.68	19	5.42	8.42	14	4.05
Reading Comprehension Questions	2	6.62	40	2.71	1.00	3	1.00	1.25	4	.5
	3	11.60	46	3.38	4.00	6	2.28	6.00	1	–
	4	14.46	43	2.68	9.00	4	.81	8.50	6	3.2
	5	16.11	43	2.29	9.66	6	1.21	9.33	3	1.52
	Total	12.29	172	4.50	6.36	19	3.72	6.42	14	4.07

Table 7.11. Performance of each group on the measures of language related skills with the mean scores (M), standard deviations (SD) and the number of the individuals in each grade (N)

					poor comprehenders					
		average comprehenders			average decoders			poor decoders		
Measures	Grade	M	N	SD	M	N	SD	M	N	SD
Listening Comprehension	2	29.20	39	5.53	24.00	2	5.65	27.25	4	8.05
	3	32.36	46	3.84	28.33	6	3.32	27.00	1	–
	4	33.74	43	3.71	32.75	4	2.06	33.00	6	1.54
	5	36.09	43	2.26	33.40	5	5.12	33.33	3	3.05
	Total	32.92	171	4.62	30.35	17	4.87	31.00	14	5.09
Vocabulary	2	69.32	40	9.28	64.66	3	14.50	72.00	4	4.54
	3	70.80	45	8.26	70.33	6	8.84	59.00	1	–
	4	76.97	41	5.41	78.75	4	2.21	74.50	6	6.25
	5	82.92	41	5.88	79.83	6	8.37	74.33	3	3.51
	Total	74.94	167	9.09	74.21	19	10.03	72.64	14	6.19

Table 7.12. Performance of each group on the measures of phonological/decoding skills with the mean scores (M), standard deviations (SD) and the number of the individuals in each grade (N)

					poor comprehenders					
		average comprehenders			average decoders			poor decoders		
Measures	Grade	M	N	SD	M	N	SD	M	N	SD
Non-word Reading Score	2	27.40	40	2.89	27.00	3	2.64	24.75	4	2.98
	3	28.57	45	2.13	29.33	6	.51	27.00	1	–
	4	28.46	41	1.70	28.00	4	1.82	23.50	6	3.72
	5	28.97	41	1.38	28.83	6	1.16	26.00	3	5.29
	Total	28.36	167	2.16	28.52	19	1.57	24.64	14	3.62
Non-word reading Fluency	2	.41	40	.13	.48	3	.16	.26	4	.04
	3	.59	45	.18	.52	6	.04	.31	1	–
	4	.62	41	.17	.61	4	.15	.33	6	.11
	5	.76	41	.22	.84	6	.45	.34	3	.11
	Total	.59	167	.21	.63	19	.29	.31	14	.09
Sound Deletion	2	12.78	38	2.30	14.00	3	1.00	9.00	3	2.64
	3	13.08	46	2.34	10.66	6	2.73	12.00	1	–
	4	13.62	43	1.46	13.25	4	1.70	12.00	6	3.22
	5	13.90	44	1.78	13.83	6	1.60	9.50	2	.70
	Total	13.36	171	2.03	12.73	19	2.35	10.83	12	2.85

Table 7.13. Performance of each group on the measures of orthographic skills with the mean scores (M), standard deviations (SD) and the number of the individuals in each grade (N)

					poor comprehenders					
		average comprehenders			average decoders			poor decoders		
Measures	Grade	M	N	SD	M	N	SD	M	N	SD
Matching Words	2	12.72	40	4.15	4.00	2	2.82	9.75	4	.50
	3	19.28	45	4.40	14.50	6	4.67	6.00	1	–
	4	20.07	41	4.69	14.75	4	2.62	19.50	6	6.68
	5	21.74	43	4.1	19.50	4	5.68	22.33	3	2.08
	Total	18.55	169	5.47	14.50	16	6.08	16.35	14	7.23
Word Chains 1	2	22.52	40	11.31	13.00	2	14.14	14.33	3	6.42
	3	37.02	45	11.81	40.16	6	8.23	11.00	1	–
	4	41.25	40	8.15	37.00	4	3.36	38.50	6	7.39
	5	45.85	42	4.88	36.66	6	9.68	36.33	3	9.07
	Total	36.78	167	12.77	35.27	18	11.38	30.30	13	13.44
Orthographic Choice	2	14.10	40	5.04	5.00	2	.00	8.75	4	2.21
	3	17.86	46	6.68	8.80	5	3.03	8.00	1	–
	4	25.97	42	5.53	21.50	4	5.19	22.16	6	5.67
	5	27.73	42	4.21	22.50	4	5.97	22.33	3	4.72
	Total	21.42	170	7.80	15.33	15	8.49	17.35	14	7.92

Table 7.14. Performance of each group on the measures of speeded access with the mean scores (M), standard deviations (SD) and the number of the individuals in each grade (N)

					poor comprehenders					
		average comprehenders			average decoders			poor decoders		
Measures	Grade	M	N	SD	M	N	SD	M	N	SD
RAN Words	2	29.22	40	10.40	29.96	3	11.09	49.75	4	27.81
	3	23.04	45	9.41	26.32	6	3.61	40.72	1	–
	4	18.98	41	4.08	20.95	4	3.06	29.20	6	10.23
	5	17.46	41	3.24	19.64	6	3.15	26.13	3	8.14
	Total	22.15	167	8.69	23.66	19	6.13	35.23	14	18.22
RAN Objects	2	40.18	40	11.00	39.16	3	5.25	36.45	4	7.55
	3	33.75	45	7.06	34.68	6	6.60	40.25	1	–
	4	32.49	41	7.48	34.97	4	4.84	35.93	6	7.46
	5	30.40	41	5.06	33.98	6	5.36	39.35	3	7.89
	Total	34.16	167	8.62	35.23	19	5.50	37.12	14	6.84

The results presented in Tables 7.8 and 7.9 indicated that the children with poor comprehension levels but average range or better decoding skills showed deficits compared to the average comprehenders on the Listening Comprehension measure and two of the three orthographic processing measures (the Matching and Orthographic Choice tasks). In contrast, the children with difficulties in both reading comprehension and decoding performed poorly, compared to the average comprehenders, on most of the measures except the Vocabulary and RAN object naming tasks, though the results for Listening Comprehension and the Matching tasks were non-significant, which may suggest that deficits in these areas are not that severe. Hence, overall, these findings argue for the poor comprehenders with average to good decoding skills to show more specific deficits in language comprehension and orthographic

processing. In contrast, the poor comprehenders with weak decoding skills show weaknesses in most areas of phonological and orthographic processing, but fewer problems in language understanding. These general conclusions seem consistent with what would be predicted from a simple view of reading that argues for two relatively different types of poor reading comprehenders – though, obviously, there will be some overlap in that some children may show deficits in both decoding and language comprehension (see Catts et al., 2006).

Graphical representation of the profiles produced by the groups can be found in Figure 7.1. These are presented in terms of z-scores to provide a visual comparison of the average performance of the two groups with reading comprehension difficulties against normal expected levels of performance. A z-score for each child was calculated based on the performance of the children within the same school year/grade; that is, the difference between the child's score and the average for the grade divided by the standard deviation for that grade. Therefore, on this graph, the vertical axis indicates the number of standard deviations that each group differed from expected performance on each of the test measures. Average expected performance is signified by the 0 line in the graph. A negative z-score (a score below the 0 line) indicates performance worse than that expected and a score above the line indicates performance better than that expected. Tasks are presented along the horizontal axis, with verbal skills on the left, followed by the decoding measures, the orthographic measures, and the measures for speed of processing to the right.

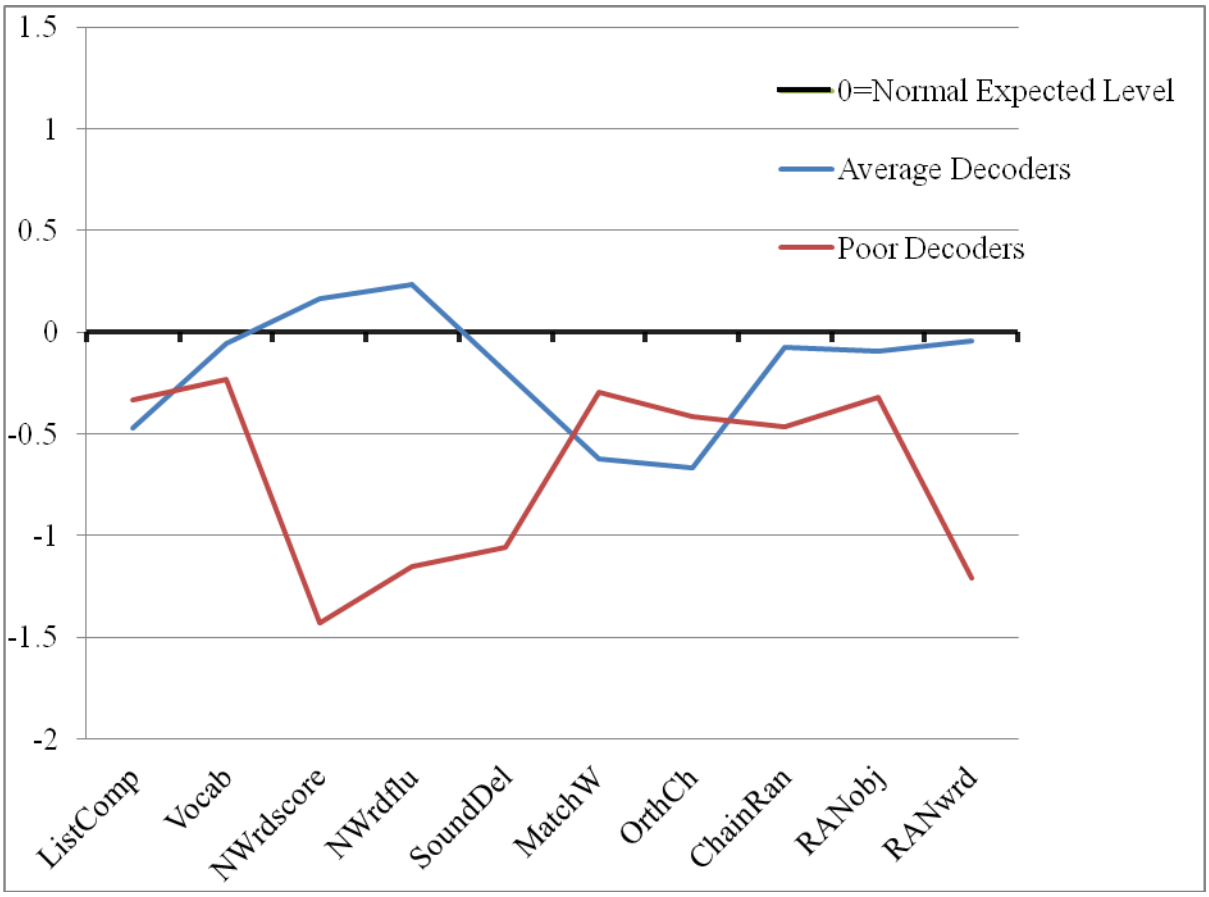

Figure 7.1. Comparison between the performances of the Average Decoders with that performed by the Poor Decoders on the measures

Note. ListComp=Listening Comprehension, Vocab=Vocabulary, NWrdscore=Non-word Reading Score, NWrdflu=Non-word Reading Fluency, SoudnDel=Sound Deletion, MatchW=Matching Words, WChain=Word Chains 1, OrthCh=Orthographic Choice, RANObj= Rapid Automatized Naming of Objects, RANWrd=Rapid Automatized Naming of Words

The graph visually represents the findings of the analyses of covariance and shows the weak performance by the poor comprehender-poor decoder children across many of the measures in the study. However, this presentation also shows the relatively severe levels of deficits in decoding and phonological areas shown by this group. In contrast, those children with poor comprehension skills, but average to good decoding levels, showed more specific areas of difficulty in listening comprehension and orthographic measures. Consistent with the Persian model of reading, as well as with similar models of reading (e.g., Simple View of Reading),

there was evidence that lower language ability (particularly in listening comprehension) was related to difficulties in text reading comprehension and that deficits at the word-level (either phonological or orthographic based) also accounted for difficulties in text reading comprehension across the grades tested.

7.4 Discussion

The analyses reported in this chapter compared children with reading comprehension difficulties to those who achieved expected average levels of reading comprehension in Persian.

The findings from these analyses were consistent with the Persian model of reading presented in this thesis. The model argued for language related skills, assessed by listening comprehension and receptive vocabulary knowledge, to be significant predictors of Persian reading comprehension, and that phonological and decoding skills could also explain significant proportions of variance in reading comprehension (see Chapter 5, for a review). This also has the potential to provide a framework for teaching/intervention along with developing assessment tools aimed at identifying literacy learning problems among children learning to read in Persian. As hypothesized, children with comprehension problems (lower than the expected average level – bottom 15%) showed difficulties in language related skills, particularly listening comprehension, along with problems in their word recognition skills. Plausibly, individual differences in language skills can underlie individual differences in reading comprehension: as predicted children can show poor comprehension levels despite good decoding skills. This data was consistent with studies which have reported that difficulties in receptive language understanding may lead to reading comprehension problems (e.g., Stothard & Hulme, 1992).

However, there was also evidence that poor decoding levels can be related to weak reading comprehension. Children with comprehension deficits showed difficulties in either phonological processing (as found in other research: see Nation & Snowling, 1998; Stothard & Hulme, 1995 for a review) or orthographic processing, which may be consistent with a dual pathway model (Coltheart, 1985, 2006) or the triangle model of word recognition (Plaut et al., 1996; Seidenberg & McClelland, 1989). For example, the triangle model of Plaut et al. (1996) argues for word recognition to be a parallel process of interactions between orthography, phonology and semantics. However, semantics here implies more than simply vocabulary size; it refers to the word knowledge. As suggested by the analyses of the current data, vocabulary by itself showed little evidence of difference between the groups studied (average comprehenders, poor comprehenders with average decoding skills and poor comprehenders who were also poor decoders). Rather deficits may be more likely to be found within the interactive pathways through the lexical processing system (either phonological or orthographic).

The findings of the current study also add to the studies reported by Nation and Snowling (1998), as well as Nation and Cocksey (2009), who stated that underlying semantic skills constrain both reading comprehension and the development of word recognition. For example, Nation and Snowling (1998) studied children with normal decoding skills but impaired reading comprehension and argued that these children's core difficulty in their semantic skills. Thus, although these poor comprehenders performed at the normal level on phonological tasks, they showed an impairment of semantics that compromises the use of the semantic pathway.

The current findings should inform work identifying problems of reading among the grades tested. However, since the nature of the current study was exploratory, further research is

required to confirm the conclusions derived. Perhaps, research on children with professional diagnoses of learning difficulties, such as dyslexia, in Persian might be conducted to confirm the findings of this study.

7.5 Conclusion

The analyses reported in this chapter compared Persian monolingual children with reading comprehension difficulties to those who achieved at expected levels of reading comprehension in Persian. The findings verified the model proposed in this thesis (Chapter 5) and suggested that children with comprehension problems (lower than the expected average level – bottom 15%) had difficulties in language related skills, particularly listening comprehension, as well as word recognition weaknesses suggestive of deficits in either phonological or orthographic processes, or the pathways connecting phonology, orthography and semantics (within the triangle model) that lead to text reading comprehension deficits. However, further research is required to confirm the causal relationship identified in this work.

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Chapter 8

General Discussion

8.1 Introduction

The primary objectives of this thesis were: (i) to examine underlying cognitive-linguistic skills as potential predictors of Persian reading comprehension in order to develop a model of reading comprehension for this orthography (see Chapter 3 for a review of the Persian orthography and the features that make it an interesting orthography to consider); and (ii) to determine whether English-derived models of reading comprehension, such as the simple view of reading (SVR) and the component model of reading (CMR), can explain variability in reading development across languages (Duncan, 2010; Goulandris & Snowling, 2003) and thereby inform potential universal models of reading (Frost, 2012).

The current research was undertaken through three studies: Study 1 focused on developing the Persian model of reading comprehension based on testing a reasonably large cohort of monolingual Persian children in the early stages of reading acquisition; Study 2 was designed to examine the developed model by assessing its ability to explain variability in a different cohort of children who are learning literacy in English and Persian; and, finally, Study 3 was designed to investigate underlying skills deficits in children with reading comprehension difficulties. The findings of these three studies are briefly summarized.

The findings of Study 1, consistent with English models of reading, indicated that Persian reading comprehension levels were predicted by measures of linguistic competence and word decoding, with the latter being predicted by phonological and orthographic processing skills. However, orthographic skills and speed of processing showed predictions of Persian reading

comprehension that were independent of word decoding processes, somewhat different findings to that predicted from English-language derived models (see Chapter 5 for a review). This led to the development of the Persian model of reading comprehension that will be discussed further in this chapter. (Figure 5.1 is re-presented below for ease of discussion.)

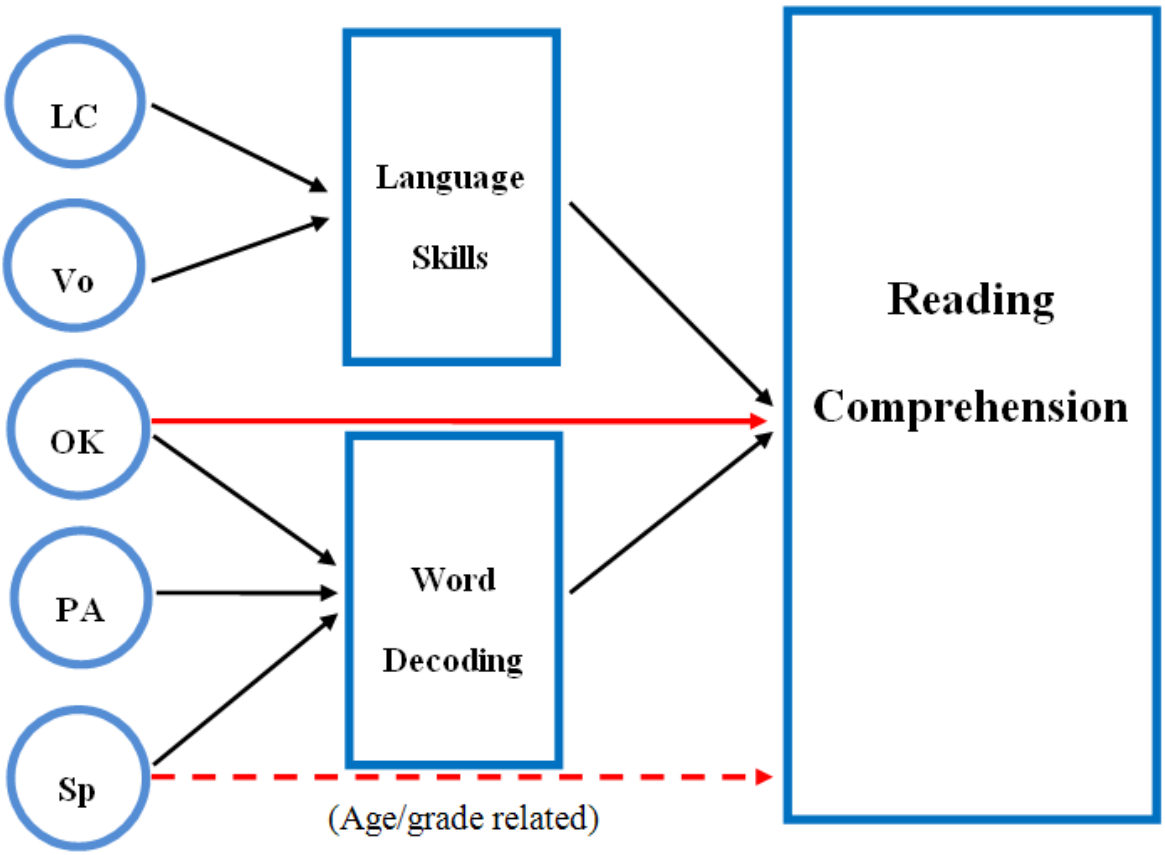

Fig. 5.1. Monolingual Persian literacy model

Note. LC=listening comprehension, Vo=vocabulary, PA=phonological awareness, OK=orthographic knowledge, Sp=speed

This Persian model of reading was examined in Study 2 where bilingual Persian-English children were tested on the measures of the study. The findings replicated and extended the model proposed in Chapter 5 (see Fig. 5.1) as a reasonable explanation of variability in Persian reading levels. The findings also demonstrated that orthographic measures predict

literacy skills from an early age. Therefore, overall, the findings supported the Persian reading comprehension model proposed in Chapter 5 of this thesis. However, some contrasts with the monolingual data were identified. Analyses across grades indicated that the lower grade bilingual children tend to rely more on orthographic knowledge to process decoding whereas for older children there was an increasing trend for phonological skills to be influential: in the Persian monolingual data, both skills areas seem to be predictive across grade levels. Additionally, whereas speed of processing showed evidence of growing as a predictor of reading comprehension levels across the grade levels studied in the Persian monolingual data, this trend was not evident in the bilingual findings where speed of processing seemed to show little influence on comprehension levels despite its influence on word decoding skills consistent with the monolingual data.

For the work reported in Study 3, children with reading comprehension difficulties were selected from the monolingual data and potential areas of problems based on hypotheses derived from the model were analysed. The findings verified the model proposed in this thesis (Fig. 5.1) and suggested that children with comprehension problems had difficulties in language related skills, particularly listening comprehension, as well as word recognition weaknesses suggestive of deficits in either phonological or orthographic processes, or the pathways connecting phonology, orthography and semantics (within the triangle model: Plaut et al., 1996) that lead to text reading comprehension deficits. Such findings suggest explanations of reading deficits consistent with a simple model viewpoint and, therefore, are consistent with the general conclusions of this thesis.

Given these findings, this general discussion chapter begins with a brief review of the Persian model of reading. This is followed by a discussion of the underlying cognitive-linguistic skills needed for the development of reading comprehension. The discussion also considers

how the research reported in this thesis addresses broader theoretical implications, such as the move towards a universal model of reading. The final sections of this chapter outline the implications for practice, limitations of the study reported and directions for future research.

8.2 Theoretical implications of the Persian model of reading comprehension

The present research work, similar to those advocating cross-language studies to develop universal theories/models of reading (e.g., Frost, 2012; Goswami, 2012; Perfetti, 2012; Perfetti et al., 2013), is firstly about Persian reading but its findings/conclusions apply to theories/models of reading in general to bring in congruent elements of various orthographies to move towards a universal model of reading (Frost, 2012). English, being reported as an exceptional outlier orthography with low transparency and many inconsistencies and complexities (e.g., Share, 2008; Ziegler et al., 2010), has led researchers to criticize the dominant English-driven models/theories of reading and demand for research on other orthographies to evaluate the current models of reading (Share, 2008; Frost 2012). Investigation into the Persian orthography is of interest in response to the demand towards a universal model of reading since the orthography has its own interesting features: it is polygraphic as some phonemes are represented by more than one grapheme but it is not plohyphonic with more direct (one-to-one) phoneme-grapheme correspondence (highly transparent when fully vowelized). Suggestions are made, based on the findings of the research reported in this thesis, to address the broader theoretical implications of the findings of this research – perhaps towards a universal model of reading.

The findings of the research reported in this thesis indicated that Persian reading comprehension levels were predicted by measures of linguistic competence and word

decoding. In addition, word decoding was predicted by phonological and orthographic processing skills. These findings seem consistent with predictions based on English-language data. However the orthographic and speed of processing measures also showed predictions of Persian reading comprehension that were independent of word decoding processes, a somewhat different finding to that predicted from English-language derived models. The components of the model will be discussed further in details.

8.2.1 Language related skills

Linguistic comprehension is reported to be a significant predictor of reading comprehension (e.g., Tunmer & Chapman, 2012). While listening comprehension is commonly used as an index for linguistic comprehension (Aaron et al., 2008; Adlof et al., 2006; Hoover & Gough, 1990; Joshi & Aaron, 2000; Tunmer & Chapman, 2012), it has not been left unchallenged through concerns of necessities of inclusion of some other aspects of language to produce a more reliable index for linguistic competence assessment (Kirby & Savage, 2008; Ouellette & Beers, 2010). Nation and Snowling (2004) reported that vocabulary could explain unique variance of reading comprehension. Hence, in the current work, listening comprehension and receptive vocabulary have been used in parallel as an index for linguistic competence. The findings of this research argue for the importance of linguistic competence in successful Persian reading comprehension in both Persian monolingual and Persian-English bilingual cohorts. Linguistic competence, consistent with the findings from English models, explains unique variance of reading comprehension across grades, even relatively early grades in reading acquisition.

However, Persian language related skills in the bilingual data seemed to be more predictive of reading comprehension than found in the monolingual Persian data. This may be because the average age of the bilingual participants was higher than the monolingual cohort and

previous research has suggested that older, more experienced readers, show more effects of listening comprehension compared to word-level decoding skills on reading comprehension than found in younger cohorts (e.g., Bell & Perfetti, 1994; Rayner et al., 2001). However, an alternative explanation is that there is more variability in language levels in the bilingual group due to some children having poor L2 skills which lead to poor understanding of text. Any influence of linguistic competence is unlikely to be caused by an underlying deficit as L1 language skills might be expected to increase the level of prediction in L2 literacy (i.e., an underlying language deficit is likely to be even more apparent in L1) and the bilingual analyses indicated little effect of L1 over that of the L2 measures. The bilingual data showing that the language effects was more apparent for the passage task than the Cloze task suggest a third explanation related to teaching or experience (which will be considered further in the sub-section on practical implications). However, to decide between these different potential interpretations, further research focusing on different language factors will be required.

Poor linguistic competence has been also reported to be related to reading comprehension difficulties (e.g., Stothard & Hulme, 1992). Comparisons of children with reading comprehension difficulties to those who achieved expected average levels of reading comprehension in Persian indicated that children with lower comprehension also had difficulties in language related skills, particularly listening comprehension. Thus, the findings from this research work support the hypothesis that individual differences in language skills can underlie individual differences in reading comprehension.

In summary, research reported in this thesis highlights the importance of language related skills within the SVR model. This is achieved through both various statistical analyses (such as factor analysis, stepwise and hierarchical regression analyses) and cross sectional studies of two divergent cohorts (monolingual and bilingual children). Consistent with the universal view in

regards with the importance of linguistic comprehension in reading comprehension, it is suggested through the findings of the thesis that listening comprehension and vocabulary should fall on the language related skills (linguistic comprehension). The differences between the spoken form and the written form of the language (diglossia), as was evident in the language/orthography studied in this thesis, did not influence the levels of predictions of reading comprehension explained through linguistic comprehension/language related skills.

8.2.2 Decoding: Phonological and orthographic processing

Decoding skills also proved to predict Persian reading comprehension in the data presented in this thesis. Early decoding is heavily dependent on letter-sound relationships; letter-sound knowledge is also essential to consolidate orthographic representations required for automatization of silent word reading or sight word knowledge (Ehri, 2005). Sight word recognition refers to reading from memory which occurs when any word can be read sufficiently and unconsciously. In the current work (see Kirby & Savage, 2008; Ouellette & Beers, 2010), decoding skills were assessed by non-word reading, which was taken as an indicator of a concentration on the grapheme-phoneme relationships. Orthographic measures were also utilized as indicators of orthographic knowledge in word recognition. Finally isolated word reading (RAN of words) was used as indicator of reading fluency in this work. Overall, all these measures proved to explain the variance in decoding across grades tested. However, orthographic knowledge also directly predicts Persian reading comprehension, after controlling for word recognition, across the grades/reading experience levels tested in this work.

Word recognition models, such as the dual route model (Coltheart, 1985, 2006) and the triangle model (Plaut et al., 1996), argue that word recognition is via lexical and/or non-lexical routes. The current data showed that phonological skills along with orthographic

knowledge significantly predict phonological decoding, consistent with the orthographic representation of the word (lexical route) activating its meaning along with letter-sound knowledge (non-lexical route). Such findings are consistent with other research highlighting the significant role of orthographic skills in Persian adults' reading (Baluch & Besner, 1991, 2001; Rahbari & Sénéchal, 2008).

Despite the Persian orthography being considered relatively transparent, with consistent grapheme-phoneme relationships (Baluch, 1993; Baluch & Besner, 1991), there are complexities when learning the orthography which have led to some calling it a mixed orthography (Rahbari & Sénéchal, 2009) (see Chapter 3 for a review on the Persian orthography). Rahbari, Sénéchal, & Arab-Moghaddam (2007) suggested that Persian children utilize phonological mediation to develop their reading, then use their orthographic skills to read when the words are practiced sufficiently. Rahbari & Sénéchal (2009) along with others (Baluch, 1993; Baluch & Besner, 1991) reported strong effects of lexicality, i.e., skilled reading in Persian is more relying on lexical processes.

However, the question under debate here revolves around the idea that underlying processes involved in reading are dependent on the degree of orthographic transparency (Orthographic Depth Hypothesis: Katz & Frost, 1992). This can be interpreted as readers of transparent orthographies trust their orthography and rely on grapheme-phoneme conversion rules, whereas readers of complex orthographies tend to rely more on graphemic representations of whole-word reading as part of their word recognition process (Wimmer & Goswami, 1994). The ceiling effect identified in the measure of non-word reading among fairly young readers is consistent with arguments about relatively transparent orthographies and suggests that these children can trust their phonological skills in sounding out the non-words through their letter-sound knowledge – the inclusion of fluency as the main measure of decoding skills is

also consistent with work on relatively transparent orthographies (e.g., Joshi & Aaron, 2000). These findings concur with those of Rahbari et al. (2007), who found that younger Persian children tended to rely on phonological skills, consistent with findings for more regular orthographies. However, the present data (from both monolingual and bilingual data) shows an early influence of orthographic processing, which Rahbari et al. did not find. This discrepancy between the two studies may be due to the measures used to examine children's orthographic knowledge. In the present study, children's orthographic skills were measured by matching words, words chains, and orthographic choice (see Chapter 4 for a review of developing measures). In contrast, Rahbari et al. used the comparison of children's performance in word and non-word reading as an index for orthographic skills. The latter index may take longer to become evident in children, which may bias it against early influences. Therefore, there may be evidence of an early-onset influence of orthographic processing in Persian when assessed with more sensitive measures.

The bilingual data (from Persian-English speakers) in this reported research also highlights that orthographic knowledge predicts literacy learning from an early age, arguing for the possibility that Persian orthographic knowledge is an important early skill for an individual to read accurately/fluently and comprehend written text. Analyses across grades indicated that lower grade children tend to rely more on orthographic knowledge to process decoding whereas for older children there was an increasing trend for phonological skills to be influential. These findings were consistent with those of Arab-Moghaddam & Sénéchal (2001) who found unique contribution of orthographic skills (9%) was higher than phonological skills (4%) among Persian-English bilingual children. (Note that Arab-Moghaddam & Sénéchal used an orthographic choice task, similar to that used in the studies reported in this thesis, to assess orthographic skills). Children learning Persian and English may rely more on their orthographic knowledge (graphemic representations of words) to

process information during initial acquisition of literacy – this may be a more secure level of processing initially – then phonological skills become more important once differences between the two orthographies have been firmly established.

Findings from the study of children with comprehension deficits in the current study also highlight difficulties in either phonological processing (e.g., Nation & Snowling, 1999; Stothard & Hulme, 1992) or orthographic processing, which may be consistent with a dual pathway model (Coltheart, 1985, 2006) or the triangle model of word recognition (Plaut et al., 1996; Seidenberg & McClelland, 1989). Again, the evidence is for both to be important in literacy acquisition from an early age and for basic reading development (i.e., word-level literacy). For phonological processing, the evidence is consistent with international findings for the relationship between phonological processing and reading acquisition, particularly at the word level. The early influence of orthographic processing, though, is worthy of further investigation.

8.2.3 Orthographic knowledge

Orthographic knowledge according to Apel (2011) refers to both mental representation of written words stored in mental lexicon (as used by Conrad, 2008) and the knowledge of letter-to-sound correspondence rules (as used by Berninger, Abbott, Vermeulen, & Fulton, 2006). To avoid confusion, orthographic knowledge in this context, consistent with similar studies, refers to the knowledge of mental graphemic representation of words (Wolter & Apel, 2010).

The findings reported in this thesis suggest that orthographic knowledge is a good predictor of word decoding and reading comprehension. The relationship with word decoding was discussed in the previous section. However, the relationship with reading comprehension may

be even more interesting. Both monolingual and bilingual data, derived from the present research, indicated that readers may rely on their orthographic knowledge (graphemic representations of words) to support the comprehension of written texts beyond that explained by the common influence of decoding skills. Persian readers are exposed to an orthography in which text can be either vowelized, and visually dense but reasonably transparent, or unvowelized, which can produce a large number of homographs and require the use of context to support written word processing. This potential complexity of orthography may make the relationship between orthographic processing and reading different from that found in other languages. The complex features of the orthography (particularly when non-vowelized) may lead to the assumption that text reading experience, and the skills associated with dealing with text understanding, may improve orthographic knowledge as much as orthographic skills support reading acquisition. Research aimed at investigating this potential reciprocal relationship should inform models of Persian reading development, as well as, potentially, theories of other languages (such as Arabic).

These findings further support the idea that orthography as the written form of the language goes beyond the simple phoneme-grapheme representation (i.e., spelling of phonemes) (Perfetti, 2012). There is obviously a key link between lexical processes and comprehension. Perfetti (2007) describes this link as, "[the] most direct at the level of short runs of text, a sentence or two, where one can observe word processing "on-line" as part of text reading." (P.375). Thus it can be assumed that orthographic knowledge may integrate the word currently being read with the ongoing representation of the text through which reading comprehension can be enhanced. However, the questions remain here are whether this link activates semantics or fast word recognition helps free up cognitive resources for higher level text comprehension. Further research is required to clarify the findings.

8.2.4 Speed of processing

Speed of processing is usually measured by naming speed; however, this has led to debates in the literature about what this measure specifically assesses. For example, some researchers subsume speed naming task as part of phonological processing (e.g., Wagner et al., 1993; Wolf & Bowers, 1999) whereas some others consider it as an indicator of general processing speed of the cognitive system (e.g., Carver, 1991, 1997). In transparent orthographies, reading speed may be a more reliable measure of individual differences in word level processing than reading accuracy (Wimmer et al., 2000); speed, in these cases, is typically a measure of word decoding fluency – or as indicative of automatic word reading. For a transparent script, accurate decoding can occur, but for the poor decoder, this may be time consuming, leading to poor levels of fluency in reading. Similarly, research shows that the speed of single word reading accounts for the substantial amounts of variance in reading comprehension performance (Perfetti, 1985). If a child has difficulty at the word reading level, these problems will logically have a negative impact on reading comprehension. In order to achieve meaning from the text, children are initially required to be fluent in decoding at the word level.

In the research reported here, speed of processing showed evidence of growing as a predictor of reading comprehension levels across grade levels tested in the Persian monolingual data, but this trend was not evident in the bilingual findings where speed of processing seemed to show little influence on comprehension levels. However, in both data sets, speed was an influence on word decoding skills. These findings are at odds with the component model of reading (CMR) (Joshi & Aaron, 2000) which suggests speed as an additive component in reading comprehension. In the CMR, when older children are able to decode printed words as fast as naming their letters, speed can explain the variance in reading comprehension. The

findings of the current study, from both monolingual and bilingual data sets, support speeded access as an influence on word decoding skills. Analyses of poor comprehensders also revealed that children who had difficulties in decoding skills were slower in naming words rapidly despite not showing difficulties in rapid naming of objects. These findings suggest that when decoding process is too slow and perhaps laborious in transparent orthographies, its negative impact on text reading comprehension is undeniable. Overall, it is suggested that speeded access be considered as a constituent of word decoding skills, and indicative of automaticity in word decoding, which then allows cognitive resources to be freed up for higher level functions that are important for reading comprehension such as integration, inferences, comprehension monitoring, etc.

The findings of the current research are suggestive that speed of processing (as assessed by the RAN measures) to be considered as an index of word decoding fluency. Speed of processing is also suggested as more of an indirect influence on reading comprehension via word decoding. One interpretation of this may again consider the variable transparency of the orthography. Hence, the independent influence of speed on reading comprehension may take some time to be evident, unlike with more transparent orthographies. One problem with this interpretation is that it seems somewhat at odds with the current findings that the non-word reading measure showed ceiling effects in accuracy. This effect is more consistent with a relatively transparent orthography – although the influence of teaching programme (for example, a focus on phonics and links between letters and sounds) may need to be considered also. Clearly, further research is needed to determine the effects of speeded accessing of verbal labels within Persian.

8.3 Practical implications of the findings and the Persian model of reading comprehension

8.3.1 Assessment tools

The proposed Persian model of reading comprehension (Figure 5.1) suggests a number of underlying cognitive skills as predictors of Persian reading comprehension in a two-component model consistent with the simple view of reading discussed throughout this thesis. This model can be used to inform the development of procedures aimed at identifying those at risk of literacy learning problems from a young age. For example, formal standardization of the measures used in the work reported in this thesis may improve assessment procedures, particularly amongst monolingual Persian speakers living in Iran (see discussion in Sadeghi, Everatt, & McNeill, 2012). This may be particularly the case for assessments targeted at identifying those with specific problems in reading comprehension, since this is an area where there is a lack of formal assessment tools across languages – indeed there are few assessment tools specifically targeted at reading comprehension deficits in English-language contexts (Woolley, 2008, 2011).As suggested by the findings reported in Study 3, measures of both components of the model, language competence and word processing, may be needed to identify those with different types of reading problems. Similarly, identification of those with word-level problems may require measures of phonological and orthographic processing – as suggested in the findings across studies 1 to 3. Standardisation of the measures developed in this study across different areas of Iran would provide the basis for comprehensive assessment procedures in Persian, which should also inform assessments of those outside of Iran, with appropriate modifications for local dialect or learning context (e.g., second language learning).

In addition, the findings of the current work concur with previous cross-language research which indicates that features of the orthography can influence the acquisition of literacy as well as how literacy deficits may be identified. Rates of improvement in reading, and literacy-related skills, may vary across different language cohorts (Seymour et al., 2003; Ziegler et al., 2010) meaning that different measures may be needed to identify difficulties in literacy acquisition. Children in the monolingual cohorts tested in the present work showed good performance in word decoding tasks when accuracy was measured, consistent with more consistent grapheme-phoneme correspondences, and suggesting that accuracy may not be a reliable identifier of word-level processing differences. Hence, as with other more transparent orthographies, measures of rate of reading (fluency) may be better identifiers of low literacy levels than measures of accuracy amongst young Persian readers (Sadeghi et al., 2012).

Similarly, measures of phonological processing may need to be considered carefully. In the present research, the measure of phonological segmentation showed a lack of variation within the grades tested and poor growth between grades. It also did not show reasonable correlations with other phonological measures used in the study (see chapter 5 for a review). This questions the usefulness of such sound segmentation tasks as assessments of variations in phonological skills in Persian. One possible explanation is that the features of the orthography may lead to the child to try to perform such segmentation task via orthographic knowledge; i.e., they segment based on spelling rather than sounds. One way of further investigating the role of orthography on such segmentation tasks is to develop sound segmentation measures comprised of words with more phonemes than graphemes (e.g., سگ /sæg/, meaning dog, has two letters but three phonemes) and words with less phonemes than graphemes (e.g., خواب /Xab/, meaning sleep, has four letters but three phonemes). If children were influenced more by spelling than sounds in the segmentation task used in Study 1, there

will be a trend for an under-estimate of segments in the first type of words but an over-estimate of the segments in the second type of words. These findings would suggest that phonological segmentation tasks may not be an appropriate way of determining phonological skills in Persian children who have learnt to read.

Another measure that may benefit from further research to clarify its primary influence is word chains (see also Chapter 5 for a review). The data from this research suggests that word chains tasks similar to those used in English-language tests, can be included as orthographic processing measures in Persian assessment tools – which is consistent with other studies in which word chains is considered as an orthographic measure (Arab-Moghaddam & Sénéchal, 2001). However, the findings presented in this thesis suggest that the presentation of materials influences whether the task loads more on orthographic or phonological skills: including word chains with Persian letters that change their shapes at the start and/or end of words and lists of random words versus connected text seems to influence the primary skills involved in the task. Clearly, it would be interesting to further study these differing versions of this task, which may help explain the cognitive skills involved in processing cursive writing systems.

8.3.2 Ideas for teaching practice

The current research, and model developed, can also be used to inform teaching practice. The research findings are suggestive of the importance of language ability, phonological skills and orthographic skills from a fairly young age in Persian reading development and also emphasize the link between orthographic skills and phonological skills. Teaching this latter link explicitly within normal classroom settings should lead to better reading acquisition outcomes. Future intervention-based research should confirm this interpretation.

The findings for relationships between spoken and written language in Persian can also be interpreted as arguing for the need to teach the link between the written form and language directly, though this can go beyond the level of grapheme and phonemes discussed above to considering the connection between comprehension skills in listening and reading. For example, future research that determined whether teaching inference skills in listening tasks can improve these skills in reading would be interesting; this may be particularly informative in Persian given the need to use comprehension of context to support word recognition in Persian text reading.

The findings may also inform work on second language acquisition through an appreciating the commonalities, similarities and differences of the two languages (i.e., Persian and English) to provide a better scaffold for literacy learning in either language as the second/additional language (see discussion in Sadeghi et al., 2012). The evidence for general similarities between the monolingual and bilingual cohorts tested in terms of the skills underlying Persian reading comprehension should support the use of best practice methods of teaching across both learning contexts. Furthermore, the evidence that language related skills, particularly listening comprehension, had a major influence on reading comprehension skills of the bilingual speakers argues that providing a rich language environment, which can be found in story groups and book clubs where children are exposed to oral language, should enhance literacy skills outcomes.

8.4 Limitations and directions for future research

In any piece of research there are limitations to what can be investigated. The present research was not able to explicitly assess the influence of accents/dialects found across the Persian speaking world (see Chapter 3 for a review). However, similar differences between spoken and written forms of Arabic (i.e., a similar form of diglossia to that found among

different groups of Persian readers) have been found to effect the influence of different skills on reading acquisition and, therefore, this is an area in need of further research. Similarly, there is a growing body of research suggesting that linguistic comprehension can influence decoding. This would mean that linguistic competence influences reading comprehension both directly and indirectly through decoding (Kendeou, Savage, & van den Broek, 2009; Tunmer & Chapman, 2012). Future studies should look into this relationship in Persian, particularly given the need to use context to support reading non-vowelized text and the nature of diglossia evident in the Persian language.

There were also additionally limitations in terms of the samples and measures used. The lack of access to standardized measures (as reported in Chapter 4 of the thesis) led to the need to develop measures for each area of cognitive skills hypothesized to be involved in reading process. Although this approach proved to be reliable for the purpose of this thesis, future research could address this limitation following the standardization of the measures developed in this work. Furthermore, the sample size was relatively small for the analyses reported for children with reading comprehension difficulties. Although it was adequate for the interpretations derived, larger sample sizes may provide greater certainty regarding the ability to generalise the findings to other contexts (Bachman, 2004). In addition, the sample analysed in this study comprised those for whom there was no known/recorded learning difficulties. Future work including samples with evidence of problems in text reading comprehension or word reading deficits would be useful.

There are also other cognitive-linguistic skills (e.g., morphological skills, working memory, etc.) that may be worthy of further attention. Investigations of morphology seem an appropriate example, given that the Persian morphology is relatively complex. The language has a high number of borrowed words from Arabic and includes both formal and informal

morphology: the morphology of informal texts is different from that in formal ones, with some features that do not exist in formal texts. This may also lead to differences in the influence of oral versus writing morphology on literacy development – with the former showing less influence given the divergence from the written form.

Clearly, other skills, such as world knowledge, motivation, etc (Aaron et al., 2008), will influence reading and figure 8.1 provides a representation of these together with the findings reported in this thesis. In Figure 8.1, the basic simple model (SVR) is presented in red-lined boxes. Those variables investigated in the present study are presented in blue-lined circles. Additional potential influences, such as morpho-syntactic awareness, variations in home language (e.g., the influence of diglossia), motivation and pedagogy, and exposure to print (including the use of first language literacy and practice with text in the additional language for those children from multilingual backgrounds) are included in the model in green-dashed shapes (as is the potential reciprocal relationship between reading comprehension and orthographic processing in Persian). Overall, this model and the proposed additions should provide a basis for further work to increase our understanding of Persian reading skills, which should inform cross-language theories.

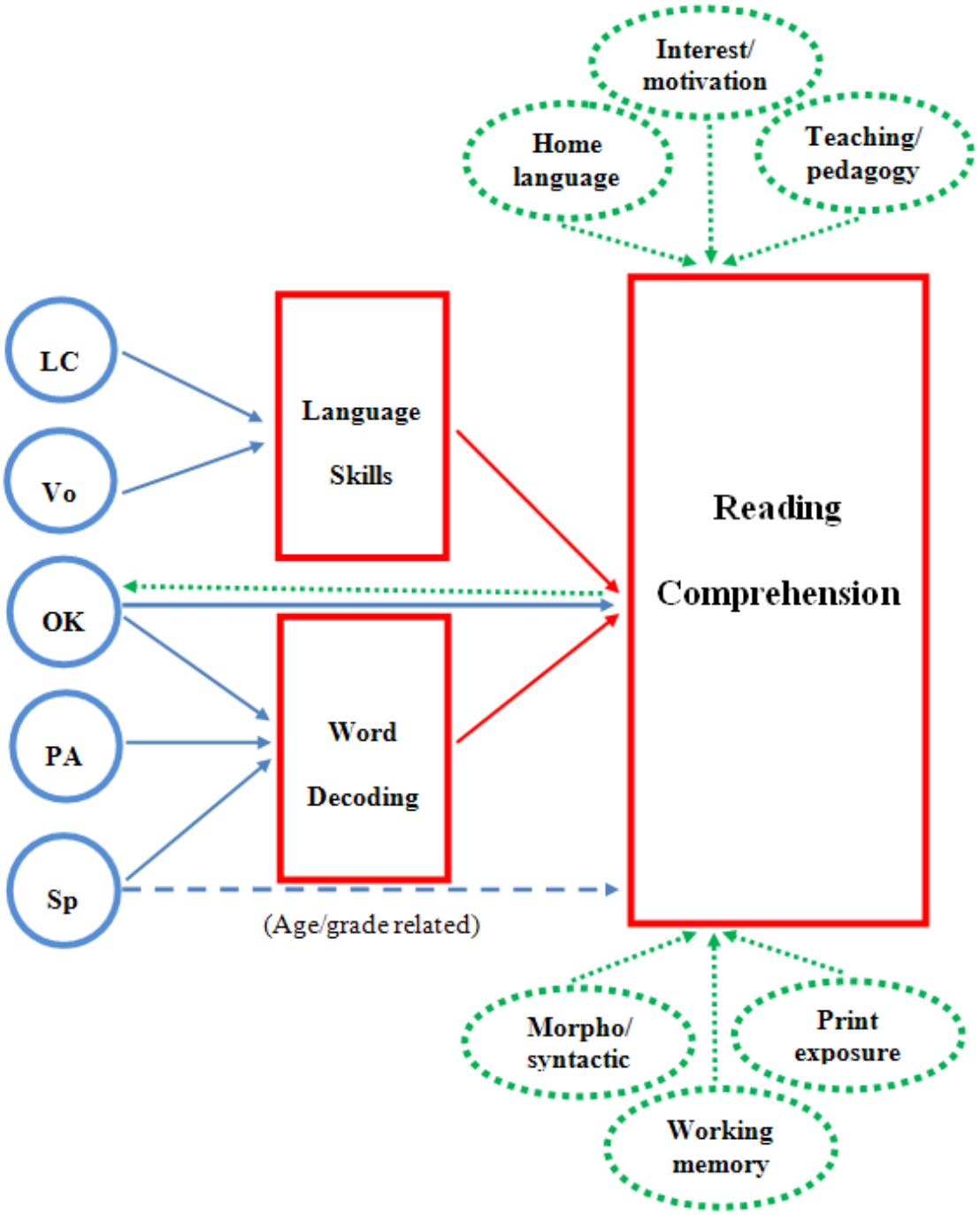

Fig. 8.1. Working model of Persian reading comprehension (modified from Sadeghi et al., 2011)

Note. LC=listening comprehension, Vo=vocabulary, PA=phonological awareness, OK= orthographic knowledge, Sp=speed

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Appendices

Appendix A: Persian consonant phonemes

	labio-labial/ labio-dental	apico-alveolar/ apico-dental	dorso-post-alveolar	dorso-palatal	dorso-prevelar	dorso-post-velar	dorso-uvular	glottal
STOP								
-voice	p	t			k			‘ (ʔ)
+voice	b	d			g		q (G)	
AFFRICATE								
-voice				c (tʃ)				
+voice				j (dʒ)				
FRICATIVE								
-voice	f	s	š (ʃ)			x		
+voice	v	z	ž (ʒ)					
NASAL	m	n						
LIQUID		l, r						
GLIDE								
-voice							h	
+voice				y (j)				

Note. Adopted from Mahootian (1997)

Appendix B: Persian vocalic phonemes

	Front	Back
high	i	u
mid	e	o
low	æ	a
diphthong		ow (ou)

Note. Adopted from Mahootian (1997)

Appendix C: Persian measures

به نام خدا
آزمون صحّت خواندن و درک مفاهیم
مدت آزمون: 10 دقیقه

کد رهگیری:..... کلاس:.....

تعداد پاسخ صحیح:		تعداد پاسخ غلط:	

متن های زیر را با دقت بخوانید و جاهای خالی را با کلمات داده شده کامل کنید. تعداد کلمه های داده شده از تعداد جاهای خالی بیشتر است.

متن اوّل:

گل برگ شکوفه درخت سبزه

بهار

بهار زیباترین فصل سال است. در این فصل درختان ..... می کنند. بوته های گل پر از غنچه می شوند و به ..... می نشینند. پروانه ها دور شمعدانی ها و گلها می رقصند. در بهار همه جا پر از چمن و ..... است.

متن دوّم:

تعطیلات جواب داد نگاه کرد

حرکت می کردند قدم می زدند ساعت قبل

حلزون

زنگ تفریح زده شد. بچه ها از کلاس بیرون آمدند. محمّد و حمید درباره ی درس ..... صحبت می کردند. محمّد گفت: راستی حمید، آیا تا به حال حلزون دیده ای؟ حمید .....: چند روز پیش تعداد زیادی حلزون لابلای سبزه ها دیدم. آنها خیلی آرام به این سو و آن سو ..... . من تا خواستم به شاخک های یکی از آنها دست بزنم، تمام بدنش را به نرمی در صدف خود فرو برد. محمّد به صورت حمید ..... و فهمید که او هم از این کار ترسیده بود.

متن سوّم:

آفتابی	دوّم	خنک	گرم	سرد
آغازین	بارانی	می ریزند	جوانه می زنند	خواب

چهار فصل

خدای مهربان همه فصل های سال را با نظم آفریده است. هر سال چهار فصل دارد. فصل ..... سال، بهار است. با آغاز بهار مردم ایران سال نو را جشن می گیرند. در بهار درختان شکوفه می کنند و به گل می نشینند. تابستان دومین فصل سال است. در تابستان هوا خیلی گرم می شود و مردم به جاهای ..... مثل دریا و کوهستان سفر می کنند. پائیز سومین فصل سال است. در این فصل هوا ..... است. در این فصل برگ های درختان کم کم زرد می شوند و ..... . با آغاز پائیز، مدرسه ها دوباره باز می شوند. زمستان چهارمین فصل سال است. هوا در زمستان ..... است. در این فصل، درختان به ..... زمستانی فرو می روند و به همراه مردم منتظر بهار و آغاز سال نو می شوند.

متن چهارم:

محکم	زنبور	گاو	زیان های
ضعیف	سلامت	بیمار	خواص

فواید شیر

شیر بهترین غذا و کامل ترین نوشیدنی است که از حیواناتی مثل ..... ، گوسفند، بز و یا شتر تهیه می شود. اما بعضی از بچه ها شیر را دوست ندارند و از خوردن آن فرار می کنند. راستی شما چطور؟ آیا هر روز شیر می نوشید؟ شیر ..... بسیار زیادی دارد. به عنوان مثال نوشیدن شیر سبب ایجاد شادابی در ما می شود و استخوان هایمان را ..... می سازد. شیر میکروب ها و بیماری ها را نیز از بدن ما دفع می کند. پس سعی کنید هر روز حدّ اقل یک لیوان شیر بنوشید تا همیشه ..... باشید.

متن پنجم:

مزّه	رنگ	بو	گاز
منجمد کردن	گرم کردن	مایع	حباب

دی اکسید کربن در نوشابه

نوشابه های گازدار حاوی گاز دی اکسید کربن می باشند. این ..... در فشار بالا و درجه دمای پائین در آنها حل شده است. افزودن دی اکسید کربن به نوشابه سبب ایجاد یک اسید ضعیف می شود. این اسید ..... نوشابه را اندکی تند می کند. هم چنین این اسید به عنوان نگهدارنده نیز عمل می کند.

هنگامی که در بطری نوشابه ای را باز می کنید، فشار درون بطری کاهش می یابد و در نتیجه دی اکسید کربن محلول به گاز تبدیل می شود و به صورت ..... از سطح آن خارج می شود. اگر در بطری برای مدتی باز بماند، متوجه خواهید شد که دیگر حباب های گاز در آن ظاهر نمی شوند و نوشابه تندی خود را نیز از دست خواهد داد.

صنعت نوشابه سازی بزرگترین بازار برای دی اکسید کربن محسوب می شود. اما استفاده از آن فقط به همین جا ختم نمی شود. دی اکسید کربن جامد بهتر از آب یخ زده می تواند مواد را سرد کند. به همین دلیل از آن برای ..... غذا ها نیز استفاده می گردد.

متن ششم:

محو	عدل	زین	نماینده
گشت و گذار	قصر	حیاط	مأمور

پادشاه ظالم

در زمان های قبل، پادشاه ستمگری زندگی می کرد که معروف به حاکم گناهکار بود. او به هر بهانه ای اموال مردم، حتّی فقرا را تصاحب می کرد. روزی وی با عدّه ای از بزرگانش در ایوان ..... خود نشسته بود و به صحرا می نگریست. ناگهان اسبی زیبا را دید که در حال تاخت به سمت کاخ بود. آنچنان شیفته ی اسب شد که دستور داد آن را بگیرند.

مأموران اسب را گرفتند اما چون اسب سرکش بود، نتوانستند بر روی آن ..... بگذارند. پادشاه که بسیار شیفته ی این اسب شده بود، شخصاً نزدیک آن آمد. اسب در مقابل حاکم آرام ایستاد. وقتی پادشاه از آرام بودن اسب مطمئن شد، زین بر پشت اسب نهاد و چون به پشت سر اسب رفت تا قلّاب زین را در زیر دم اسب بگذارد، ناگهان اسب با هر دو پایش چنان بر سینه او کوبید که وی نقش بر زمین شد و سبب شد در دم جان دهد. اسب هم بلافاصله پا به فرار گذاشت و در صحرا ..... شد. کسی نتوانست اثری از اسب بیابد. مثل این که اسب .....

کشتن حاکم ظالم بود و پس از این که مأموریت خود را انجام داد، ناپدید شد.آری خداوند اساس دنیا را بر پایه ی ..... و انصاف قرار داده است. بارها دیده شده است که ظالمان در همین دنیا کیفر اعمال ناپسند خود را دیده اند.

به نام خدا
آزمون صحّت خواندن و درک مفاهیم
مدت آزمون: 15 دقیقه

کد رهگیری:..... کلاس:.....

تعداد پاسخ صحیح:		تعداد پاسخ غلط:	

متن های زیر را با دقّت بخوانید و به سؤالات چهار جوابی آن ها پاسخ دهید. به یاد داشته باشید که تنها یکی از پاسخ ها درست است.
متن اوّل:

برف مثل فرش سفید

اکنون در روستایی که محمّد زندگی می کند، زمستان است. هوا بسیار سرد شده است و برف می بارد. برف زمین را مانند فرشی سفید پوشانده است. محمّد در یک کارخانه کار می کند. رفت و آمد او به خاطر برف سخت شده است اما محمّد خوشحال است چون او می داند که بارش برف برای کشت و کار کشاورزی بسیار پر فایده است.

1) وقتی برف می بارد، ..... .

الف) محمّد غمگین می شود.

ب) محمّد سر کار نمی رود.

ج) محمّد فرش سفید بر روی زمین پهن می کند.

د) محمّد به سختی به کارخانه می رود.

2) چرا محمّد از این که برف می بارد خوشحال است؟

الف) چون محمّد برف را دوست دارد.

ب) چون وقتی برف می بارد، محمّد تعطیل می شود.

ج) چون برف مثل فرش سفید است.

د) چون برف برای کشاورزی مفید است.

3) محمّد کجا کار می کند؟

الف) در روستا **ب) در شهر**

ج) در مزرعه **د) در کارخانه**

متن دوّم:
شب مهتابی

دیروز معصومه به همراه مادرش به سفر رفت. آنها به خانه ی عموی معصومه در شهر کرمان رفتند. آنها در راه از شهرهای کاشان و یزد گذشتند. دختر عموی معصومه، ثریّا است و در کلاس اول درس می خواند. وقتی معصومه و مادرش به شهر کرمان رسیدند، شب بود. شب مهتابی زیبایی بود. معصومه به آسمان نگاه کرد. ستاره ها بسیار نورانی و درخشان بودند. معصومه از ثریّا پرسید: چرا اینجا ستاره ها زیبا تر از تهران دیده می شوند؟ ثریّا پاسخ داد: در اینجا هوا آلوده نیست و تمیزی هوا باعث می شود ستاره ها زیباتر دیده شوند. معصومه در حالی که از تماشای ستاره ها لذّت می برد با خود آرزو کرد: ای کاش هوای شهر تهران هیچ وقت این قدر آلوده نمی شد.

1) معصومه در کدام شهر زندگی می کند؟
الف) کرمان

ب) کاشان

ج) یزد

د) تهران

2) معصومه و ومادرش کی به مقصد رسیدند؟
الف) دیروز ب)غروب

ج) روز د) شب

3) چرا معصومه می توانست ستاره ها را نورانی تر ببیند؟
الف) ستاره ها درخشان و پر نور هستند.

ب) هوای کرمان آلوده است.

ج) ستاره ها فقط در شب های مهتابی دیده می شوند.

د) آلودگی هوای تهران باعث می شود که ستاره ها خوب دیده نشوند.

4) معصومه با خود چه آرزویی کرد؟
الف) ای کاش می توانست به پیش ستاره ها برود.

ب) ای کاش هوای کرمان تمیز و پاکیزه بود.

ج) ای کاش هوای تهران تمیز و پاکیزه بود.

د) ای کاش ثریّا خواهرش بود.

متن سوّم:

دوست عزیزم فاطمه، سلام، امیدوارم حالت خوب باشد. قول داده بودم نامه ای بنویسم و در آن از سال تحصیلی که گذشت، برایت بگویم.

امسال، برای من سالی پر از خاطرات شیرین و به یاد ماندنی بود. من هیچ گاه اولین درس را که با نسیم حیات بخش پاییزی و سخنان سودمند آموزگارم آغاز شد، فراموش نخواهم کرد.

راستی، ما امسال کتاب جدیدی را به نام «هدیه های آسمان»، مطالعه کردیم. نمی دانی با چه ذوق و شوقی آن را به صورت گروهی می خواندیم! مطالب بسیار ارزشمندی از این کتاب آموختیم. فهمیدیم که باید با یکدیگر صمیمی و مهربان بوده وهمکاری داشته باشیم. با زندگی پیامبران و امامان (ع) و بندگان خوب خدا آشنا شدیم.

چون در این سال به سنّ تکلیف مي رسیدیم با وظایف دینی آشنا شدیم. یاد گرفتیم چگونه نماز بخوانیم و خدا را عبادت کنیم. از قیام امام حسین (ع) و یارانش درس دینداری و آزادگی گرفتیم.

آموختیم باید مواظب حیوانات و گیاهان باشیم و به طبیعت آزار نرسانیم. مطمئن هستم تو نیز از خواندن این کتاب لذّت خواهی برد .

راستی فاطمه جان، حالا فهمیدم که معلّم هم یک هدیه ی آسمانی است.

دوست همیشگی تو، زهرا

1) بهترین عنوان را برای متن بالا انتخاب کنید.

الف) خاطره
ب) نامه ای به یک دوست
ج) گفتگو با معلّم
د) سنّ تکلیف

2) "هدیه های آسمان" چیست؟

الف) معّلم های فاطمه
ب) همه ی معلّم ها
پ) نام یک کتاب است.
ت) نام یک مدرسه است.

3) چرا سال تحصیلی امسال برای زهرا سالی پر خاطره بود؟

الف) چون معلّم خوبی داشت.
ب) چون کتاب خوبی داشت.
ج) چون اولین درس در پائیز آغاز شده بود.
د) چون چیزهای زیادی یاد گرفت.

4) کدام یک از جملات زیر درست است؟

الف) زهرا، امسال به سنّ تکلیف می رسد.

ب) زهرا هم اکنون یک سال است که به سنّ تکلیف رسیده است.

ج) زهرا هنوز به سنّ تکلیف نرسیده است.

د) فاطمه هنوز به سنّ تکلیف نرسیده است.

متن چهارم:

مشورت در کارها و مشکلاتی که گاهی اوقات برای انسان به وجود می آید، همواره در دین اسلام تاکید شده است. خدای بزرگ در قرآن کریم به پیامبر اکرم (ص) فرموده است: در کارها با اصحاب و یاران خود مشورت کن. از این توصیه می توان به نقش مهمّ مشورت در زندگی پی برد.

در زندگی روز مرّه، بسیار اتّفاق افتاده است که کارهای بی مشورت سرانجام خوبی نداشته اند و بی سرانجام ماده اند. اما کارهایی که با مشورت با افراد دانا و دوستان با تجربه انجام می یابد، بدون نقص بوده و مقبول همه واقع می گردند. دلیلش هم کاملاً واضح است. یک نفر به تنهایی قادر نیست همه جوانب یک موضوع را برّرسی کند و از آن آگاهی کامل حاصل نماید.

بنابراین برای همه مسلمانان و افرادی که خواهان موفّقیت می باشند لازم است که در کلیه امور به پیروی از قرآن کریم و پیامبر اکرم (ص) با افراد عالم و دانا مشورت نمایند.

1) کدام یک از جملات زیر صحیح است؟

الف) در قرآن توصیه شده است که در همه ی امور با افراد دانا مشورت کنیم.

ب) کارهای بی مشورت سرانجام خوبی دارند.

ج) در همه ی امور باید با همه دوستان و آشناهایمان مشورت کنیم.

د) مشورت کردن تنها برای مسلمانان لازم و ضروری است.

2) چرا مشورت در انجام امور، امری پسندیده است؟

الف) چون کارهای با مشورت، مورد قبول همه واقع می شود.

ب) چون پیامبر اکرم (ص) در انجام کارها با اصحاب و یارانش مشورت می کرد.

ج) چون ما باید همه ی کارهایمان را با دوستانمان در میان بگذاریم.

د) چون ما به تنهایی نمی توانیم همه ی جوانب یک کار را بسنجیم.

3) مشورت کردن به چه کسانی توصیه شده است؟

الف) به مسلمانان

ب) به پیامبر (ص)

ج) به اصحاب و یاران پیامبر (ص)

د) به همه کسانی که می خواهند موفّق شوند

4) بهترین عنوان را برای این متن انتخاب کنید.

الف) مشورت ب) پند و توصیه

ج) موفقیّت د) پیروی از قرآن

متن پنجم:

همان گونه که دوران کودکی، میان سالگی و کهن سالی از ویژگی های خاصّی برخوردار هستند، دوره جوانی نیز از اهمیّت ویژه ای برخوردار است. طبق نظر بسیاری از دانشمندان، دوره جوانی پنج سال است که از شانزده سالگی آغاز و تا بیست سالگی ادامه می یابد. این در حالی است که عدّه ی کم دیگری از دانشمندان معتقدند که این مدّت ده سال می باشد و تا بیست و پنج سالگی به طول می انجامد.

شناخت ویژگی های دوره ی جوانی برای هر فرد لازم و ضروری است. در دوره جوانی مانند سایر دوره ها با تغییر و تحوّل جسمی، امور روحی نیز تغییر می یابد. در این دوره تمایلات جدیدی در انسان شکوفا می شوند که سبب کنار گذاردن تمایلات کودکی و نوجوانی در فرد می شوند.

آنچه جوانان باید بدانند این است که با مراقب و شناخت بیشتر از خود و این دوره ی حسّاس، می توانند آینده خوب و روشنی را برای خود ترسیم سازند.

1) بیشتر دانشمندان معتقدند، دوره جوانی ..... سال می باشد.

الف) پنج ب) پانزده

ج) بیست د) بیست و پنج

2) کدام یک از جمله های زیر صحیح است؟

الف) شناخت دوره ی جوانی از اهمیّت چندانی برخوردار نیست.

ب) دوره ی جوانی تنها دوره ی با اهمیّت در طول زندگی هر فرد می باشد.

ج) دوره ی جوانی همان دوره ی نوجوانی است.

د) در دوره ی جوانی تمایلات جسمی و روحی جدیدی در انسان بوجود می آید.

3) چه توصیه ای به جوانان در مورد دوره ی جوانی شده است؟

الف) این دوره همانند دوره های دیگر در زندگی می باشد.

ب) جوانان باید نسبت به این دوره بی تفاوت باشند.

ج) جوانان باید تنها به فکر آینده ی خود باشند.

د) جوانان باید تلاش کنند تا این دوره را به خوبی درک نمایند.

4) بهترین عنوان را برای متن بالا انتخاب نمایید.

الف) دوره ی نوجوانی ب) دوره ی جوانی

ج) دوره ی میان سالگی د) دوره ی کهن سالی

متن ششم:

در بدن ما هورمونی به نام هورمون رشد وجود دارد. این هورمون در سنین کودکی، نوجوانی و اواسط دوره جوانی وظیفه ی استخوان سازی را در بدن به عهده دارد. استخوان سازی در بدن تا پایان دوره ی نوجوانی یا اواسط دوره ی جوانی ادامه دارد. یکی از عوامل تأثیر گذار بر رشد قدّ، تأمین املاح و ویتامین های ضروری برای هورمون رشد می باشد.

توصیه متخصّصان تغذیه برای نوجوانان مصرف روزانه 150 گرم گوشت، نصف تا یک لیوان حبوبات پخته، دو تا سه لیوان شیر و لبنیّات دیگر به همراه سبزیجات فراوان می باشد. نوجوانانی که در سنین رشد می باشند و افزایش قدّ خوبی ندارند، می توانند با مصرف مکمّل ویتامین ها و املاح طبق نظر پزشک و دستور مصرف هفتگی، رشد قدّ خود را بهبود ببخشند.

غذاهای دریایی مانند ماهی و میگو، جگر و دانه های روغنی همگی حاوی املاح بسیار زیادی می باشند که برای نوجوانان فواید بسیاری در بر دارد. به طور کلی به کسانی که می خواهند قدّ بلندتری داشته باشند، توصیه می شود هفته ای یکبار جگر و دو بار غذاهای دریایی میل کنند. بعلاوه خوردن چند عدد بادام، بادام زمینی و گردو نیز به طور روزانه، توصیه می شود.

1) وظیفه ی هورمون رشد در بدن چیست؟

الف) رشد قدّ ب) استخوان سازی

پ) تأمین املاح ت) تأمین ویتامین های ضروری

2) کدام یک از جملات زیر صحیح است؟

الف) هورمون رشد در همه ی سنین در بدن انسان فعال است.

ب) نوجوانان برای بهبود رشد قدّ شان باید به پزشک مراجعه کنند.

ج) مصرف غذاهای دریایی سبب جلوگیری از رشد قدّ در انسان می شود.

د) استخوان سازی در بدن انسان تا دوره ی میان سالگی به طول می انجامد.

3) توصیه متخصّصان تغذیه به نوجوانان چیست؟

الف) دقت در تغذیه خود

ب) مصرف حدّاقل هفته ای یک بار جگر

ج) فراهم آوردن املاح و ویتامین های لازم برای هورمون رشد

د) مصرف کافی گوشت، حبوبات، سبزیجات و لبنیّات به طور روزانه

4) بهترین عنوان را برای این متن انتخاب کنید.

الف) تغذیه ی مناسب

ب) هورمون ها

ج) بلند قامت

د) توصیه ی پزشکی

متون آزمون صحت شنیدار

سلام

یه داستان براتون می خونم و شما باید بهش خوب گوش کنین، بعد ازتون در مورد داستان سوال می کنم که باید جواباتونو در پاسخنامتون علامت بزنین. یادتون باشه جواب "آره" جعبه سفید و جواب "نه" جعبه خاکستری که باید علامت زده شه.
حالا اگه آماده هستین شروع می کنیم.

متن اوّل:

آذر و ابوذر با خونوادشون تو یکی از روستاهای مازندران زندگی می کنن. اونا تصمیم گرفتند امروز برای گردش برن کنار دریا. مادر خوراک لذیذی براشون آماده کرد. اونا تو راه از دیدن دشت های سر سبز و پر طراوت خیلی لذّت بردن. بچّه ها در کنار دریا با صدف ها بازی کردن و بسیار لذّت بردن. امروز به آذر و ابوذر خیلی خوش گذشت.

سوال 1: آیا آذر و ابوذر توی روستا زندگی می کنن؟
سوال 2 : آیا آذر و ابوذر برای تفریح به دریا رفتن؟
سوال 3: آیا آذر و ابوذر دوستاشونو هم با خودشون بردن؟
سوال 4 : آیا آذر و ابوذر برای نهار به رستوران رفتن؟
سوال 5: آیا آذر و ابوذر توی دریا شنا کردن؟
سوال 6: آیا بهشون خوش گذشت؟
سوال 7: آیا آذر و ابوذر امروز تصمیم گرفتن برن لب دریا؟

متن دوّم:
سال نو

امین به همراه خانوادش دور سفره ی هفت سین نشسته بودن و مشتاقانه منتظر لحظه ی تحویل سال بودن. لحظه ی تحویل سال را با شنیدن صدای شیپور و طبل از تلویزیون جشن گرفتن. ابتدا پدر قرآن را از داخل سفره برداشت و چند آیه از اونو تلاوت کرد. سپس اونا روی هم دیگر رو بوسیدن و با خوردن شیرینی، عید رو به هم تبریک گفتن. پدر چند اسکناس نو از لابلای قرآن برداشت و به عنوان عیدی به امین و خواهرش داد. بعد همگی خوشحال و خندون، کمی آجیل و شیرینی خوردن و برای یکدیگر در سال جدید آرزوی موفقیّت کردند. بعد هم، همه دسته جمعی برای تبریک سال نو، آماده رفتن به خونه پدربزرگ و مادر بزرگ شدند.

خوب حالا با دقت به سوالها گوش بدبن.
سوال 1: آیا خانواده ی امین در خونه ی پدر بزرگ امین منتظر لحظه ی تحویل سال نو بودند؟
سوال 2 : آیا پدر امین پس از تحویل سال قرآن خوند؟
سوال 3: آیا پدر امین برای عیدی به اونا پول داد؟
سوال 4 : آیا مادر هم به اونا عیدی داد؟
سوال 5: آیا بعد از تحویل سال همگی به خونه دایی امین رفتن؟
سوال 6: آیا اونا بعد از تحویل سال غذا خوردن؟
سوال 7: آیا همزمان با لحظه ی تحویل سال، صدای شیپور و طبل از تلویزیون پخش شد؟

متن سوّم:
خاطره
به خونه که رسیدم از شدّت عصبانیّت به اتاقم رفتم و دراز کشیدم. آخه تیم مون توی فینال مسابقات فوتبال باخته بود. وقتی مادرم متوجّه ی ناراحتی من شد، برام یه شربت خنک آورد و گفت: پسرم غصّه نخور! دنیا که به آخر نرسیده، مگه این ضرب المثل رو نشنیدی که می گه:

در نومیدی بسی امید است پایان شب سیه سپید است

من مطمئنّم شماها بعداً موفّق می شین ، فقط باید با اراده و پشتکار تلاش کنین و هر کسی وظیفه ی خودشو تو گروه به درستی انجام بده تا بتونین پیروز بشین. بعد از ظهر اون روز به همراه پدر و مادر سوار اتوبوس شدیم و به دیدن عمو عبدالله که مریض بود رفتیم. خونواده ی عمو از دیدن ما خیلی خوشحال شدند. بعد از احوال پرسی از عمو، برای رعایت حالش بدون سر و صدا با بچّه ها توی حیاط خونه مشغول بازی شدیم. موقع خداحافظی دو خونواده قرار گذاشتن که بعد از بهبودی حال عمو، برای زیارت بارگاه امام رضا (ع) به مشهد برن و توی راه از تماشای منظره ها و چشم اندازهای طبیعی ایران لذّت ببرند. به قول معروف: هم فاله و هم تماشا!
شب وقتی به رختخواب رفتم، یه بار دیگه حرف های مادرم رو پیش خودم مرور کردم و تصمیم گرفتم هیچ وقت نا امید نشم. اون شب با این که خیلی خسته بودم، امّا احساس خوبی داشتم.

سوال 1: آیا مادر به پسرش توصیه کرد که نا امید نشه و دوباره تلاش کنه؟
سوال 2 : آیا اونا برای دیدن عمو عبدالله به مشهد رفتن؟
سوال 3 : آیا دلیل ناراحتی گوینده ی این خاطره بیماری عمو عبدالله بود
سوال 4 : آیا بچه ها توی اتاق بازی کردن؟
سوال 5: آیا معنای ضرب المثل "در نومیدی بسی امید است پایان شب سیه سپید است" اینه که توی شب آدم نا امید می شه؟
سوال 6: آیا اونا برای دیدن عمو عبدالله به بیمارستان رفتن؟
سوال 7: آیا وقتی پسر شب به رختخواب رفت هنوز خسته و ناامید بود؟

متن چهارم:
لقمان حکیم

شاید شما هم نام لقمان حکیم رو شنیده باشین. لقمان مردی عالم بود و با دانشمندان زیادی نشست و برخاست می کرد. نمازش رو سر وقت می خوند، پرهیزکار بود و به عدالت رفتار می کرد. کمتر حرف می زد و زمانی که حرف می زد، سخنانی حکیمانه ازش شنیده می شد. امانت دار و راستگو بود و برای مردم دلسوزی می کرد. اگر دو نفر با هم دعوا می کردن، میونشون آشتی برقرار می کرد. لقمان از خویشان حضرت ایّوب (ع) بود و در زمان حضرت داود (ع) زندگی می کرد. او عمری طولانی داشت. پندهای لقمان بسیار معروف است.
مقام لقمان به قدری بالا است که در قرآن کریم سوره ای به نام لقمان نازل شده. پیامبر اکرم (ص) در مورد لقمان فرمودند: " لقمان پیامبر نبود ولی بنده ای بود که بسیار فکر می کرد و به خداوند ایمان واقعی داشت. خدا را دوست می داشت و خدا هم او رو دوست می داشت."
از لقمان پرسیدند: چطوری به این مقام بالا رسیدی؟ گفت: به خاطر امانت داری، صداقت و سکوت درباره ی چیزی که به من مربوط نبود.

سوال 1: آیا لقمان مردیه که همه ی عالم اونو می شناسن؟
سوال 2: آیا دلیل مشهوربودن لقمان حکیم اینه که در زمان حضرت داود (ع) زندگی می کرده و از خویشاوندان حضرت ایّوب (ع) بوده؟
سوال 3: آیا لقمان حکیم با امانت داری و صداقتش به مقام بالایش رسید؟
سوال 4: آیا در قرآن کریم سوره ای به نام لقمان وجود دارد؟
سوال 5: آیا لقمان حکیم پیامبر بود؟

متن پنجم:
سنجیده سخن گفتن

یکی از پادشاهان هندی، وزیری بسیار دوست داشتنی داشت. روزی این وزیر در میان صحبت هاش گفت: مرغی وجود داره که خوراکش سنگ داغ و آهن گداخته ست. اونایی که این حرف رو شنیدن نمی تونستن اونو باور کنند. پادشاه با خشم گفت: چرا چیزی را که عقل نمی پذیرد، ادّعا می کنی، وزیر؟ و وزیر که دید هیچ بهانه ای فایده نداره و پافشاری روی حرفش فقط خشم شاه رو زیاد تر می کنه پس از لحظه ای تأمّل گفت: پادشاها! برای اثبات سخنم، چند ماه به من فرصت دهید تا به بغداد سفر کنم و نمونه ای از این مرغ را برایتان بیاورم.
وزیر آماده سفر شد و پس از چندین ماه مسافرت خودش رو به بغداد رساند و بعد از جستجو فهمید که مرغ آتش خوار، همان شترمرغ است. او به بیابان رفت و با زحمت فراوان بالاخره تونست یه شتر مرغ را به دام بندازه و با خودش بیاره.
وقتی وزیر بیچاره پس از یک سال بالاخره به نزد شاه برگشت، همه از دیدن چنین مرغی تعجّب کردند. وزیر با خوشحالی گفت: پادشاه بداند که مشقّت بسیاری تحمّل کردم تا به این مرغ دست یافتم. به دستور پاشاه، پاره های خرد و ریزی از آتش را جلوی شترمرغ گذاشتن و او اونا رو به راحتی بلعید. وزیر خوشحال بود و منتظر دریافت پاداشی مناسب از طرف پادشاه بود.
پادشاه از جاش بلند شد و کنار وزیر اومد. دستش رو روی شونه وزیرگذاشت و گفت: ای وزیر، هر چند حرف خودت را به ثابت کردی ولی ما را در مورد عقل خود به شکّ انداختی.

وزیر که از تعجّب خشکش زده بود، با شرمندگی پرسید: جسارت نیست اگر بپرسم که چرا پادشاه چنین اندیشه ای دارد؟ پادشاه گفت: ای وزیر، سخنی را که برای اثبات آن یک سال از عمرت را باید صرف کنی، بهتر است اصلاً نگویی.
وزیر دریافت که سخن پادشاه درست است. هر چند که اون تونسته بود حرفش رو اثبات کنه امّا تلف شدن عمر یک ساله اش نمی توانست توجیه خوبی داشته باشه.
سوال 1: آیا وزیر پس از خشم پاشاه در مورد سخنش از پادشاه خواست تا او را ببخشد؟
سوال 2: آیا کار وزیر در مقابل وقتی که صرف کرده بود، ارزشمند بود؟
سوال 3: آیا مرغی که وزیر آورده بود، توانست پاره های آتش را ببلعد؟
سوال 4: آیا وزیر از بغداد با خودش یه عقاب آورد؟
سوال 5: آیا وزیر توانست حرفش را به اثبات برساند؟
سوال 6: آیا نتیجه اخلاقی این داستان این است که ما باید همه ی حرف هایمان را به اثبات برسانیم؟
سوال 7: آیا مرغ آتش خوار واقعاً وجود داشت؟
سوال 8: آیا وزیر مرغ آتش خوار را از بغداد به ایران آورد؟

متن ششم:
از هر دست بدی، از همون دست می گیری

روزی کشاورز فقیری در اسکاتلند به نام فلمینگ در حالی که سخت مشغول کار و تهیّه ی رزق و روزی برای خودش و خونوادش بود، صدای ناله ی کودکی رو از باتلاقی که تو اون نزدیکی بود، شنید. بلافاصله، وسایلش رو به زمین انداخت و برای کمک به کودک دوید.
کودک بیچاره تا کمر تو گل های باتلاق فرو رفته بود. کودک که حسابی ترسیده بود، در حالی که جیغ می کشید تلاش می کرد تا خودش رو نجات بده. فلمینگ، دستش رو به سمت کودک دراز کرد و اونو از مرگ حتمی نجات داد.
روز بعد، درشکه ای مجلّل در جلوی خونه فلمینگ کشاورز ایستاد و مردی که لباس فاخری به تن داشت از اون پیاده شد. اون مرد کسی نبود به جز پدر کودکی که کشاورز نجاتش داده بود.
مرد به کشاورز گفت: می خوام برای نجات پسرم به شما پاداش خوبی بدم.
کشاورز اسکاتلندی پاسخ داد: من برای کاری که کردم از شما پاداش قبول نمی کنم. در همین حال، پسر کشاورز جلوی در خونه ظاهر شد.
مرد ثروتمند پرسید: این کودک ، پسر شما است؟
و کشاورز با افتخار گفت : آره.
مرد ثروتمند گفت: بیایید با هم یه معامله کنیم. بذارید آموزشی رو که برای فرزند خودم فراهم آوردم رو برای پسر شما هم فراهم کنم. من یقین دارم که اگه این پسر مثل پدرش باشه، یه روز باعث می شه که ما هر دو مون به وجودش افتخار کنیم.
بنابراین، پسر کشاورز به بهترین مدرسه های اون زمان رفت و در نهایت از بهترین دانشگاه پزشکی لندن فارغ التحصیل شد. این پسر تونست نام خودشو به عنوان کاشف پنی سیلین در دنیا به ثبت برسونه.
اون پسر کسی نبود به جز الکساندر فلمینگ، کاشف پنی سیلین.
سالها بعد پسر همون مرد نجیب زاده ای که از باتلاق توسط کشاورز نجات داده شده بود، دچار بیماری ذات الریّه شد. فکر می کنید چه چیزی اونو نجات داد؟ این بار پنی سیلین اونو از مرگ حتمی نجات داد.

نام این مرد نجیب زاده آقای راندولف چرچیل و نام پسرش وینستون چرچیل، سیاستمدار معروف انگلیسی بود.
واقعاً زندگی چیزی به جز این نیست که هر کاری اثری مشابه خودش رو داره و این ضرب المثل در این زمینه درسته که میگه:

از هر دست که بدی از همون دست هم می گیری

سوال 1: آیا کشاورز اسکاتلندی با شنیدن صدای ناله ی کودک از باتلاق، کارش رو رها کرد وً به کمک کودک شتافت؟
سوال 2: آیا پدر کودک پس از نجات پسرش از مرگ حتمی در باتلاق، به کشاورز فقیر اسکاتلندی پول خوبی داد؟
سوال 3: آیا پسر کشاورز فقیر در بهترین دانشگاه پزشکی لندن درس خواند؟
سوال 4: آیا وینستون چرچیل کاشف پنی سیلین است؟
سوال 5:آیا پنی سیلین داروی بیماری ذات الریّه است؟
سوال 6: آیا فلمینگ یه سیاستمدار بود؟

پاسخنامه آزمون صحّت شنیدار

کد رهگیری:..... کلاس:.....

متن اوّل: کنار دریا

	بلی	خیر
1)	☐	☐
2)	☐	☐
3)	☐	☐
4)	☐	☐
5)	☐	☐
6)	☐	☐
7)	☐	☐

متن دوّم: سال تو

	بلی	خیر
1)	☐	☐
2)	☐	☐
3)	☐	☐
4)	☐	☐
5)	☐	☐
6)	☐	☐
7)	☐	☐

متن سوّم: خاطره

	بلی	خیر
1)	☐	☐
2)	☐	☐
3)	☐	☐
4)	☐	☐
5)	☐	☐
6)	☐	☐
7)	☐	☐

متن چهارم: لقمان حکیم

	بلی	خیر
1)	☐	☐
2)	☐	☐
3)	☐	☐
4)	☐	☐
5)	☐	☐

متن پنجم: سنجیده سخن گفتن

	بلی	خیر
1)	☐	☐
2)	☐	☐
3)	☐	☐
4)	☐	☐
5)	☐	☐
6)	☐	☐
7)	☐	☐
8)	☐	☐

متن ششم: از هر دست بدی از همون دست می گیری

	بلی	خیر
1)	☐	☐
2)	☐	☐
3)	☐	☐
4)	☐	☐
5)	☐	☐
6)	☐	☐

پاسخنامه آزمون واژگان

کد رهگیری:..... کلاس:.....
سنّ: .....سال و ..... ماه

تعداد پاسخ صحیح	

تمرین:

1)	آبی	الف	**ب**	ج	د
2)	جوراب	الف	ب	**ج**	د

سری اوّل:

1	شانه	الف	ب	**ج**	د
2	دندان	الف	ب	ج	**د**
3	مسجد	**الف**	ب	ج	د
4	دریا	الف	ب	ج	**د**
5	ملخ	الف	ب	**ج**	د
6	قایق	الف	**ب**	ج	د
7	اردک	الف	ب	**ج**	د
8	انار	الف	ب	**ج**	د
9	کندو	الف	ب	ج	**د**
10	پژمرده	الف	**ب**	ج	د

11	کوسه	الف	ب	**ج**	د
12	نانوایی	الف	**ب**	ج	د
13	شالیزار	الف	ب	ج	**د**
14	پاکیزه	الف	**ب**	ج	د
15	تیغ	**الف**	ب	ج	د
16	هدیه	الف	**ب**	ج	د
17	زیارت	**الف**	ب	ج	د
18	مهتابی	الف	ب	**ج**	د
19	چوپان	الف	ب	**ج**	د
20	بهار	**الف**	ب	ج	د

تعداد پاسخ صحیح	

سری دوّم:

1	خندان	**الف**	ب	ج	د
2	روزنامه	الف	ب	ج	**د**
3	منظّم	الف	ب	**ج**	د
4	عجله	الف	ب	**ج**	د
5	نویسنده	الف	ب	ج	**د**
6	نانوا	الف	**ب**	ج	د
7	عکّاس	**الف**	ب	ج	د
8	دم	الف	ب	**ج**	د
9	موج	الف	ب	ج	**د**
10	علف خوار	الف	ب	ج	**د**
11	نگران بودن	**الف**	ب	ج	د
12	کارخانه	**الف**	ب	ج	د
13	گونه	الف	**ب**	ج	د
14	بلند	**الف**	ب	ج	د
15	پچ پچ کردن	**الف**	ب	ج	د
16	حشره	الف	ب	**ج**	د
17	معاینه کردن	الف	**ب**	ج	د
18	کشان کشان	الف	ب	ج	**د**
19	خیس	**الف**	ب	ج	د
20	صندوق	الف	**ب**	ج	د

سری سوّم:

1	غروب	الف	ب	**ج**	د
2	زرّین	**الف**	ب	ج	د
3	چکیدن	الف	ب	**ج**	د
4	ریسمان	الف	ب	**ج**	د
5	کمین کردن	الف	**ب**	ج	د
6	شلوغ	الف	ب	ج	**د**
7	برخاستن	الف	ب	**ج**	د
8	یادداشت کردن	الف	ب	**ج**	د
9	برهنه	الف	**ب**	ج	د
10	اندیشیدن	**الف**	ب	ج	د
11	رنگارنگ	**الف**	ب	ج	د
12	حرم	الف	ب	**ج**	د
13	فضانورد	الف	ب	ج	**د**
14	مور	الف	**ب**	ج	د
15	تمبر	الف	ب	ج	**د**
16	ارّه	الف	**ب**	ج	د
17	رهگذر	الف	ب	**ج**	د
18	شرمنده	الف	**ب**	ج	د
19	گریستن	**الف**	ب	ج	د
20	مشعل	الف	**ب**	ج	د

تعداد پاسخ صحیح	

سری چهارم:

1	سیرک	الف	**ب**	ج	د
2	مخترع	الف	**ب**	ج	د
3	اردحام	الف	ب	**ج**	د
4	چهره	الف	**ب**	ج	د
5	اصابت کردن	الف	ب	**ج**	د
6	برکه	الف	**ب**	ج	د
7	آسائیدن	**الف**	ب	ج	د
8	پاورچین پاورچین	**الف**	ب	ج	د
9	رژه	الف	**ب**	ج	د
10	حیرت کردن	الف	ب	**ج**	د
11	تهی دست	**الف**	ب	ج	د
12	طبیب	الف	ب	ج	**د**
13	عیادت کردن	الف	ب	ج	**د**
14	فرتوت	الف	ب	ج	**د**
15	کاوشگر	الف	ب	**ج**	د
16	ماتم زده	**الف**	ب	ج	د
17	مشورت کردن	الف	ب	**ج**	د
18	معدنچی	**الف**	ب	ج	د
19	وداع کردن	الف	**ب**	ج	د
20	آبگینه	الف	**ب**	ج	د

تعداد پاسخ صحیح	

سری پنجم:

1	آرمیدن	**الف**	ب	ج	د
2	طلوع	الف	**ب**	ج	د
3	مدد کردن	**الف**	ب	ج	د
4	نگریستن	الف	ب	**ج**	د
5	تقاطع	**الف**	ب	ج	د
6	حریق	الف	**ب**	ج	د
7	درآمیختن	الف	ب	ج	**د**
8	رصد خانه	الف	ب	**ج**	د
9	فرسوده	الف	**ب**	ج	د
10	قطور	الف	**ب**	ج	د
11	گلشن	**الف**	ب	ج	د
12	ملّاح	الف	ب	**ج**	د
13	پراکندن	الف	ب	**ج**	د
14	نالیدن	الف	ب	**ج**	د
15	نحیف	**الف**	ب	ج	د
16	یال	الف	ب	ج	**د**
17	هامون	الف	ب	ج	**د**
18	لنگر	الف	**ب**	ج	د
19	تعمیر کردن	الف	ب	**ج**	د
20	مجسّمه ساز	الف	ب	ج	**د**

تعداد پاسخ صحیح	

بخش مهارت های آوایی:

تشخیص صداها	تعداد صحیح:	
حذف صداها	تعداد صحیح:	
خواندن ناکلمات	تعداد صحیح:	زمان :

بخش نامیدن تصاویر:

نامیدن حروف	زمان:	تعداد غلط:
نامیدن کلمات	زمان:	تعداد غلط:
نامیدن اشیاء	زمان:	تعداد غلط:
نامیدن رنگ ها	زمان:	تعداد غلط:

آزمون تشخیص صداها

در این قسمت چند کلمه خواهی شنید. با دقت گوش کن و صداهای آن ها را بگو.
حالا با هم تمرین می کنیم.

تمرین:

	کلمه	صداها	تعداد صداها
1	دفتر	د ، ـَ ، ف ، ت ، ـَ ، ر	6
2	کتاب	ک ، ـِ ، ت ، ا ، ب	5

خوب، اگر حاضری، شروع می کنیم.

	کلمه	صداها	تعداد صداها
1	میز	م ، ی ، ز	3
2	هوا	ه ،ـَ ، و ، ا	4
3	دکتر	د ، ـُ ، ک ، ت ، ـُ ، ر	6
4	تاب	ت ، ا ، ب	3
5	طلا	ط ، ـَ ، ل ، ا	4
6	شاهین	ش ، ا ، ه ، ی ، ن	5
7	شمشیر	ش ، ـَ ، م ، ش ، ی ، ر	6
8	زنبور	ز ،ـَ ، ن ، ب ، و ، ر	6
9	یخچال	ی ، ـَ ، خ ، چ ، ا ، ل	6
10	زنگ	ز ، ـَ ، ن ، گ	4
11	کوفتگی	ک ، و ، ف ، ت ، ـِ ، گ ،ی	7
12	شطرنج	ش ، ـَ ، ط ، ر ، ـَ ، ن ، ج	7
13	عروسک	ـَ ، ر ، و ، س ، ـَ ، ک	6
14	مکانیک	م ، ـِ ، ک ، ا ، ن ، ی ، ک	7
15	کارگردان	ک ، ا ، ر ، گ ، ـَ ، ر ، د ، ا ، ن	9

آزمون حذف صداها

کلمات زیر را پس از حذف صداها بگو.

تمرین:

	کلمه	صدای حذف شده	کلمه ی جدید
1	زیر	ز	ایر
2	دهقان	ن	دهقا
3	ورزش	ز	وراِش
4	کمک	م	کُ اَک
5	آزار	آ	زار
6	قاشق	ش	قاُق

حالا اگر سوالی نداری، می توانیم شروع کنیم.

	کلمه	صدای حذف شده	کلمه ی جدید
1	سوزن	ن	سوزَ
2	قابلمه	ق	آبلمه
3	مهندس	س	مهندِ
4	چراغ	غ	چرا
5	پرتقال	ل	پرتقا
6	پدر	د	پِ اَر
7	مادر	د	ما اَر
8	پلنگ	ن	پلَگ
9	قالیباف	ل	قایباف
10	مدرسه	ر	مد اِسه
11	دهان	د	اَهان
12	مداد	م	اِداد
13	رانندگی	د	رانن اِگی
14	کباب	ک	اَباب
15	تابلو	ت	آبلو

آزمون خواندن ناکلمات و شبه کلمات

کلمات زیر را با سرعت و با صدای بلند بخوان. این کلمات بدون معنی هستند. به معنی آنها توجه نکن. مهم خواندن درست این کلمات است.

تمرین:

1	پال	2	کوژان	3	فاب	4	نکیلا
5	خیکار	6	موسیلان	7	قیژان	8	ماروش

حالا اگر سوالی نداری، می توانیم شروع کنیم.

1	ویر	2	موک	3	ناش	4	طیس	5	فار
6	مان	7	ظیغ	8	پوق	9	صاپ	10	پوص

11	بارات	12	ماسیپ	13	ماژوک	14	پوشیر	15	پوسکی
16	نالیک	17	مورسیف	18	صیداق	19	کورتین	20	میقارپ

21	سوریدان	22	ماشالی	23	سیقالپا	24	مونصاری	25	ریواردی
26	صورینازٔ	27	مودوخی	28	طانیژون	29	ظیراشی	30	هونپارسی

تشخیص جفت کلمات (معنادار) یکسان

مدّت آزمون: 1 دقیقه

کد رهگیری:..... کلاس:.....

تعداد پاسخ صحیح	

کلمات زیر را بخوان و تشخیص بده که آیا این دو کلمه یکسان هستند یا نه. اگر دو کلمه یکسان هستند، زیر آنها را خط بکش.

مثال: 1) اسناد، استاد
2) سنگر، سنگر

1) میز، میز
2) نور، بور
3) خوشه، خوشه
4) رحم، زخم
5) تولّد، تولّد
6) موسی، موسی
7) شاعر، ساحر
8) صحیح، صحیح
9) دلپذیر، دلپذیر
10) معذرت، مغفرت
11) افتخار، افتخار
12) شجاع، شجاع
13) مسرور، مغرور
14) تعظیم، عظیم
15) ضامن، ضامن
16) ارمغان، اردکان
17) پالایشگاه، پالایشگاه
18) صبور، قبور
19) منصرف، انصراف
20) حیات، حیاط
21) فرط، فرط
22) قرآن، قرآن
23) احمر، احمد
24) امداد، مداد
25) سویس،سویس
26) روز، زور
27) کشف، کشف
28) رحمت، رحمت
29) خوش، جوش
30) زیارت، زیارت
31)غصّه، قصّه
32) محبّت، محبّت
33) آغاز، آواز
34) راضی، راضی
35) حیف، کیف
36) الان، الان
37) کارد، کارت
38) شیرینی، شیرینی
39) دهه، صده
40) راوی، زاری
41) اقتباس، اقتباس
42) تفریق، تفریق
43) لرزیدن، لمیدن
44) کشک، کشک
45) طهران، تهران
46) ارز، ارض
47) ویژه، ویژه
48) مبارک، مبارک
49) هجوم، نجوم
50) نفی، نهی

تشخیص جفت کلمات (بی معنی) یکسان

مدّت آزمون: 1 دقیقه

کد رهگیری:..... کلاس:.....

تعداد پاسخ صحیح	

کلمات زیر را بخوان و تشخیص بده که آیا این دو کلمه یکسان هستند یا نه. اگر دو کلمه یکسان هستند، زیر آنها را خط بکش. توجه داشته باش که این کلمات بی معنی هستند.

مثال: 1) ملداق، ملدان
2) سنجر، سنجر

1) میجا، میحا
2) کادوخ، کادوخ
3) فارپی، فاربی
4) پامتو، پامتو
5) تفریث، تفریث
6) سیداشه، شیداسه
7) مقدوشیب، مقدوسیب
8) مضوزات، مصوقات
9) مهموش، مهموش
10) وروشک، وروشک
11) قریشکات، مریشکات
12) مشپلین، مسپلین
13) ملانی، ملانی
14) ککانی، گکانی
15)غکاشی، غکاشی
16) هیتران، کیتران
17) زردابیل، زدرابیل
18) نیسالپوش، نیسالپوش
19) یلدانشار، یلدانسار
20) جیلیپنو، جیلیپنو
21) همطزانا، همطزانا
22) راشذ، راشز
23) سیزان، قیزان
24) بوکیانوس، بوکیانوس
25) بوتال، بوتال
26) سیچر، سیچر
27) دتیش، زتیش
28) پرگیش، قرنیش
29) نستیشا، پسنیشا
30) نمکو، نمکو
31) محملاتی، محملابی
32) شمبه، شمبه
33) قرداشه، قرداشه
34) قیحابی، قیحانی
35) نستالیش، نستالیش
36) استالانی، افتالابی
37) شمشین، شمشین
38) وییپینگ، وییپینگ
39) نوسکی، یوسکی
40) میموری، مسموری
41) صلانون، صلانون
42) گیجاری، کیجاری
43) مژمران، مژمران
44)منصاران، منصاران
45) خلازه، ملازه
46) دورصام، دورصام
47) قرذابی، قردانی
48) اصلک، اصلگ
49) ارژه، ارژه
50) ترداشی، ترداشی

تشخیص جفت کلمات (بی معنی) یکسان

مدّت آزمون: 1 دقیقه

کد رهگیری:..... کلاس:.....

تعداد پاسخ صحیح	

کلمات زیر را بخوان و تشخیص بده که آیا این دو کلمه یکسان هستند یا نه. اگر دو کلمه یکسان هستند، زیر آنها را خط بکش. توجه داشته باش که این کلمات بی معنی هستند.

مثال: 1) زمیدان ، ضمیدن

2) سنجر، سنجر

1) لاسر ، لاصر
2) کادوخ ، کادوخ
3) طولار ، تولار
4) پامتو، پامتو
5) تفریث ، تفریث
6) شکوتان ، شکوطان
7) تراسق ، تراصق
8) لیانداز ، لیانداذ
9) مهموش ، مهموش
10) وروشک ، وروشک
11) مرجوزش ، مرجوضش
12) دوغاز ، دوقاز
13) ملانی، ملانی
14) مدارز ، مدارض
15) غکاشی، غکاشی
16) دویلاط ، دویلات
17) ذالند ، زالند
18) نیسالپوش، نیسالپوش
19) بلیجاق ، بلیجاغ
20) جیلینو، جیلینو
21) همطزانا ، همطزانا
22) اساریخ ، اصاریخ
23) دیسکان ، دیصکان
24) بوکیانوس، بوکیانوس
25) بوتال، بوتال
26) سیچر، سیچر
27) غرایف ، قرایف
28) سنیبات ، صنیبات
29) تلور ، طلور
30) نمکو، نمکو
31) مراقس ، مراقص
32) شمبه ، شمبه
33) قرداشه ، قرداشه
34) مجاحل ، مجاهل
35) نستالیش ، نستالیش
36) پراسیپ ، پراثیپ
37) شمشین ، شمشین
38) وییینگ ، وییینگ
39) محاوی ، مهاوی
40) شهراق ، شهراغ
41) صلانون، صلانون
42) سیقالپا ، سیغالپا
43) مژمران ، مژمران
44)منصاران، منصاران
45) شوسیا ، شوصیا
46) دورصام ، دورصام
47) تفورات ، تفوراط
48) پیرانسر ، پیرانثر
49) ارژه ، ارژه
50) تردداشی ، تردداشی

زنجیره ی کلمات به هم چسبیده
آزمون شماره 1
مدّت آزمون: 1 دقیقه

کد رهگیری:.....
کلاس:.....

تعداد پاسخ صحیح	

در این قسمت کلمه هایی به هم چسبیده را می بینی. تو باید این کلمه ها را برای خودت بخوانی و آنها را از هم جدا کنی. توجه داشته باش که کلمه ها را سریع و درست جدا کنی.

مثال: ماردیواربارا‌ن

پاسخ: مار/دیوار/باران

1) محمّدمدیردیروزمردمدرسه

2) سفیدشلوارکاغذخشنوداردک

3) کارجاروشمشیرآسمان

4) درمحورزردروزحیاط

5) آجرقرمزلوسترنقشه

6) قندغذالذیذزنبورموزصدف

7) مدارجغدموردفترمدادملوان

8) پیشنهادکامپیوترمغزبلندگورباط

9) گیتارعابرخودروعبورمرور

10)همسرمسرورغرورغیورقوری

زنجیره ی کلمات به هم چسبیده
آزمون شماره 2
مدّت آزمون: 1 دقیقه

کد رهگیری:.....
کلاس:.....

تعداد پاسخ صحیح	

در این قسمت جملاتی با کلمه هایی به هم چسبیده می بینی. تو باید این جمله ها را برای خودت بخوانی وکلمات آنها را از هم جدا کنی. توجه داشته باش که کلمه ها را سریع و درست جدا کنی.

مثال: کوه‌ها درزمستان پر از برف هستند.
پاسخ کوه‌ها/درزمستان/پر/از/برف/هستند.

۱) غروب یکی از روزهای سرد زمستان بود.

۲) انسان با ادب نزد خدا و بندگان خدا عزیز است.

۳) خوردن صبحانه باعث شادابی می شود.

٤) مسلمانان در ماه مبارک رمضان روزه می گیرند.

٥) نوجوانان باید در سلامت جسم و روح خود کوشا باشند.

٦) شمال ایران مملو از چشم اندازهای طبیعی است.

۷) پرچم ایران سه رنگ دارد.

زنجیره ی کلمات به هم چسبیده
(با تغییر شکل)
آزمون شماره 3
مدّت آزمون: 1 دقیقه

کد رهگیری:.....
کلاس:.....

تعداد پاسخ صحیح	

در این قسمت کلمه هایی به هم چسبیده را می بینی که کاملاً به هم چسبیده اند. تو باید این کلمه ها را برای خودت بخوانی و آنها را از هم جدا کنی. توجه داشته باش که کلمه ها را سریع و درست جدا کنی.

مثال: حسندیروزتوپ
پاسخ: حسن/دیروز/توپ

1) قوربیرچممدرسهمدیر
2) برقمنطقهمیزسینیفلفلشلیلعینکمیوههویج
3) هواتوپغیوردشمنخطرناککشاورززحمتدلیر
4) درسقرآننمازلباسبلبلطبلزنجیرصورتضروریراستگو
5) پژمردهروستابیمارستانحوادثجراححریصگرسنهبینوایانپادشاه
6) اشغالطولانیآمبولانسموشکماهوارهفرشنقّاشیساختمانکوهستانبرف

زنجیره ی جملات با کلمات به هم چسبیده
(با تغییر شکل)
آزمون شماره 4
مدّت آزمون: 1 دقیقه

کد رهگیری:.....
کلاس:.....

تعداد پاسخ صحیح	

در این قسمت، مثل قسمت قبل جمله هایی را با کلمات کاملاً به هم چسبیده می بینی. تو باید این جملات را را برای خودت بخوانی و کلمه های آنها را از هم جدا کنی. توجه داشته باش که کلمه ها را سریع و درست جدا کنی.

مثال: کتاباسمانیمسیحیانانجیلاست.
پاسخ:کتاب/اسمانی/مسیحیان/انجیل/است.

1) بهنامخداوندبخشندهومهربان
2) مردمایرانباآغازبهارسالنوراجشنمیگیرند.
3) مردمبهدیدنیکدیگرمیروندوبزرگترهابهکوچکترهاعیدیمیدهند.
4) سرزمینایرانمهددانشمندانبزرگیمانندابوعلیسیناوابوریحانمیباشد.
5) شمانوجوانانغیورایرانزمینبایدایرانرابهاوجعظمتبرسانید.

آزمون تشخیص صحیح کلمات

مدّت آزمون: 1 دقیقه

کد رهگیری:..... کلاس:.....

تعداد پاسخ صحیح	

کلمات زیر را بخوان و زیر کلمه ی صحیح را خط بکش.

مثال: غذا غضا

1) احترام	اهترام	16) خاطره	خاتره
2) سندوق	صندوق	17) فهرست	فحرصت
3) آسایش	آثایش	18) اخم	عخم
4) زحمت	ذحمت	19) افصانه	افسانه
5) تیق	تیغ	20) عادل	آدل
6) نسیم	نثیم	21) زروری	ضروری
7) آقبت	عاقبت	22) فضا	فذا
8) صحیح	صهیح	23) استقلال	اصطقلال
9) ازدواج	عزدواج	24) تلگراف	طلگراف
10) سپاس گزار	سپاس گذار	25) ضامن	زامن
11) آقاز	آغاز	26) سفید	ثفید
12) فاسله	فاصله	27) سهرا	صحرا
13) استعداد	اصطعداد	28) استخراج	اصتخراج
14) ثفات	صفات	29) تهقیق	تحقیق
15) لزیز	لذیذ	30) محتاج	مهتاج

آزمون نامیدن حروف

<u>حروف تمرینی</u>

**در این قسمت کارتی را به تو نشان می دهم که در آن حروف الفبا وجود دارد. تو باید آنها را نام ببری.
توجه داشته باش که این کار را دقیق و سریع باید انجام بدی.**

ن	ل	ی	م	ز	ک
و	ب	پ	ع	ط	س

ن ل ی م ز ک ب و س

ط ع پ ک ز ل م ی ن

ب ط س و پ ع ل ک ی

ط م ن پ س ز و ب ع

آزمون خواندن کلمات آشنا

در این قسمت کارتی را به تو نشان می دهم که در آن تعدادی کلمه نوشته شده است. تو باید آنها را درست و تند بخوانی.

توجه داشته باش که این کار را باید دقیق و سریع انجام بدی.

کلمات تمرینی

نان	لباس	اتوبوس	مدرسه
بازی	مهندس	تعطیلات	خودنویس

نان	اتوبوس	بازی	تعطیلات
بازی	تعطیلات	مدرسه	مهندس
مهندس	مهندس	لباس	مدرسه
تعطیلات	مدرسه	مهندس	بازی
لباس	مدرسه	مهندس	خودنویس
مهندس	خودنویس	بازی	اتوبوس
بازی	تعطیلات	اتوبوس	نان
اتوبوس	بازی	نان	مهندس

آزمون نامیدن تصاویر

تمرین: در این قسمت کارتی را به تو نشان می دهم که در آن چند تصویر وجود دارد.

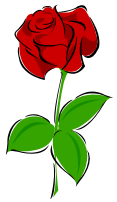
تو باید نام این تصویر ها را بگویی. توجه داشته باش که این کار را دقیق و سریع باید انجام دهی

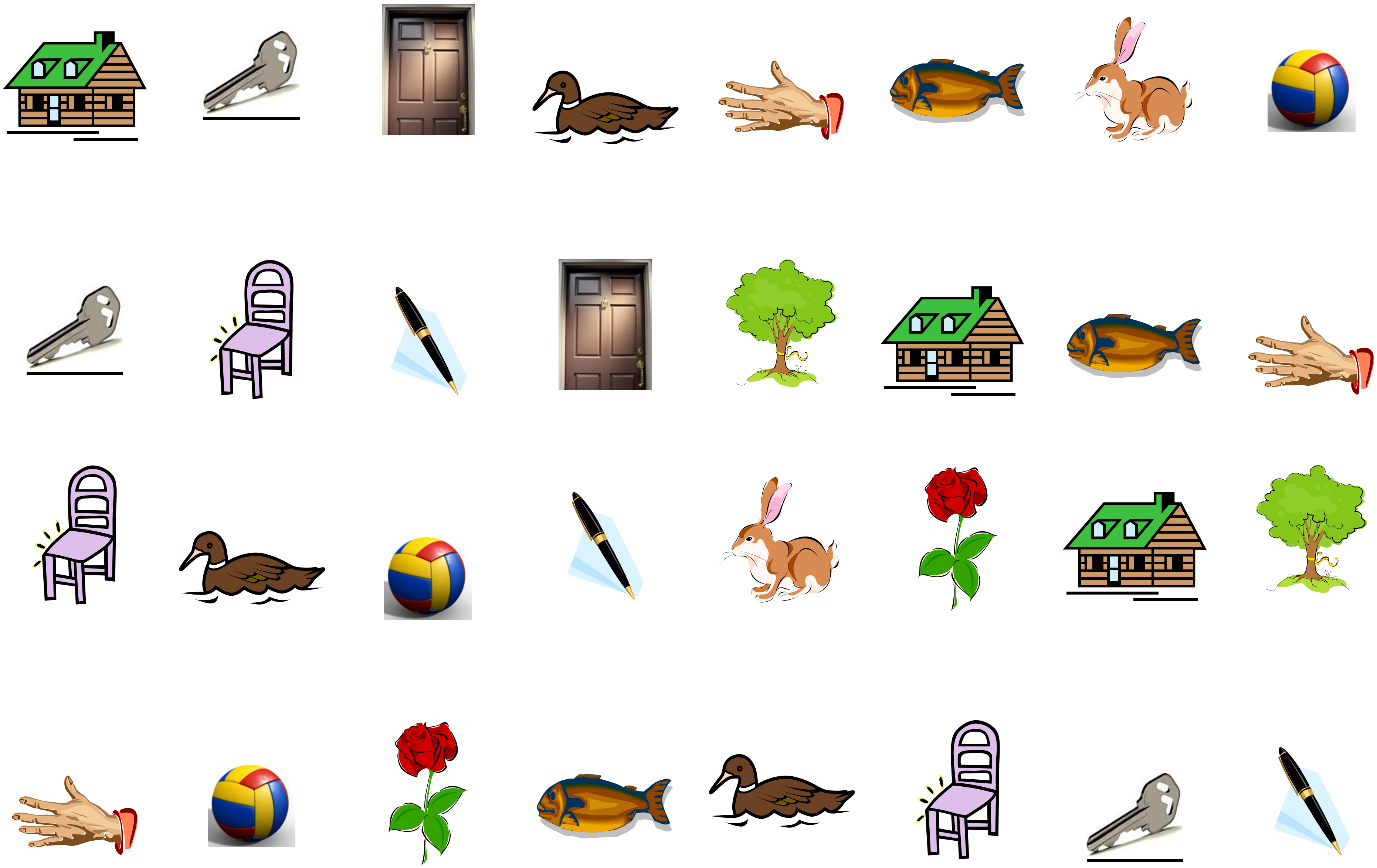








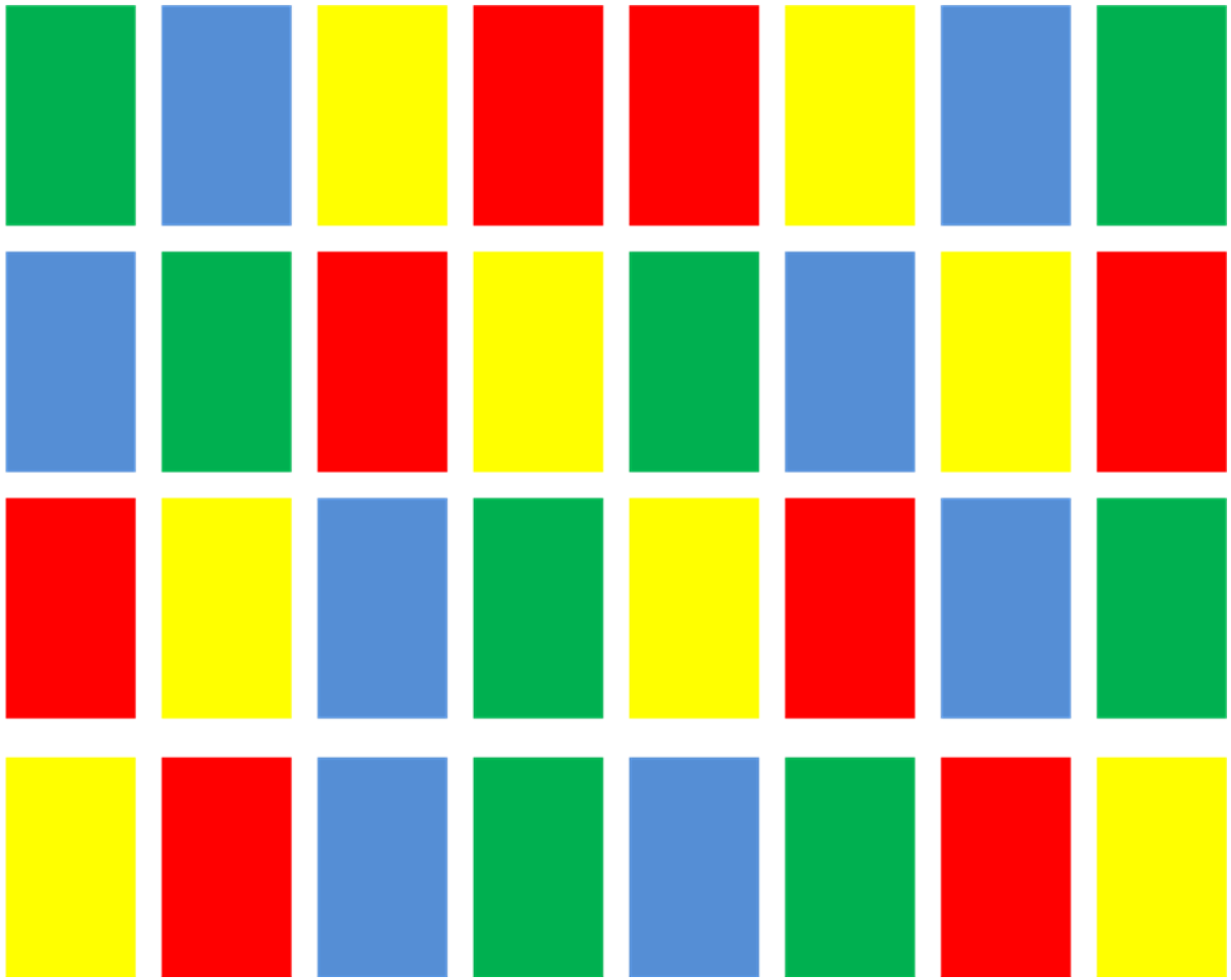


آزمون نامیدن رنگ ها

تمرین: در این قسمت کارتی را به تو نشان می دهم که در آن تصویر چند رنگ وجود دارد.

تو باید نام این رنگ ها را بگویی.
توجه داشته باش که این کار را دقیق و سریع باید انجام دهی.



Appendix D: Analyses of intra-language influences

Table 1. Analyses of intra-language influences of language elated skills for reading comprehension (Cloze)

	Variables	R^2	R^2 Change	Sig. R^2 Change
1	Sex, Grade and Age	.516	.516	F=17.87 *p*<.001
2	Language related Skills (Persian)	.692	.176	F=18.05 *p*<.001
3	Language related Skills (English)	.692	.000	F=.002 *P*=.998

Table 2. Analyses of intra-language influences of language elated skills for reading comprehension (Questions)

	Variables	R^2	R^2 Change	Sig. R^2 Change	Final Beta	
1	Sex, Grade and Age	.507	.507	F=16.45 *p*<.001	Sex	.113
					Age	-.161
					Persian Grade	.510
					English Grade	.099
2	Language related skills (Persian)	.650	.143	F=12.61 *p*<.001	Listening comp.	.316
					Vocabulary	.203
2	Language related skills (English)	.683	.033	F=3.15 *P*=.05	Listening Comp.	.242
					Vocabulary	-.088

Table 3. Analyses of intra-language influences of phonological/decoding skills for reading comprehension (Cloze)

	Variables	R^2	R^2 Change	Sig. R^2 Change
1	Sex, Grade and Age	.424	.424	F=13.42 *p*<.001
2	Phonological/decoding skills (Persian)	.616	.192	F=17.71 *p*<.001
3	Phonological/decoding skills (English)	.618	.003	F=.23 *P*=.793

Table 4. Analyses of intra-language influences of phonological/decoding skills for reading comprehension (Questions)

	Variables	R^2	R^2 Change	Sig. R^2 Change
1	Sex, Grade and Age	.458	.458	F=14.59 *p*<.001
2	Phonological/decoding skills (Persian)	.548	.089	F=6.62 *P*=.002
3	Phonological/decoding skills (English)	.548	.000	F=.01 *P*=.983

Table 5. Analyses of intra-language influences of orthographic skills for reading comprehension (Cloze)

	Variables	R^2	R^2 Change	Sig. R^2 Change
1	Sex, Grade and Age	.346	.346	F=8.33 *p*<.001
2	Orthographic skills (Persian)	.485	.139	F=5.39 *P*=.002
3	Orthographic skills (English)	.497	.012	F=.445 *P*=.722

Table 6. Analyses of intra-language influences of orthographic skills for reading comprehension (Questions)

	Variables	R^2	R^2 Change	Sig. R^2 Change
1	Sex, Grade and Age	.368	.368	F=9.15 *p*<.001
2	Orthographic skills (Persian)	.441	.073	F=2.61 *P*=.059
3	Orthographic skills (English)	.468	.027	F=.970 *P*=.413

Table 7. Analyses of intra-language influences of speed of processing for reading comprehension (Cloze)

	Variables	R^2	R^2 Change	Sig. R^2 Change
1	Sex, Grade and Age	.404	.404	F=13.22 *p*<.001
2	Orthographic skills (Persian)	.451	.047	F=3.24 *P*=.045
3	Orthographic skills (English)	.452	.001	F=.044 *P*=.957

Table 8. Analyses of intra-language influences of speed of processing for reading comprehension (Questions)

	Variables	R^2	R^2 Change	Sig. R^2 Change
1	Sex, Grade and Age	.476	.476	F=16.27 *p*<.001
2	Speed of processing (Persian)	.486	.010	F=.638 *P*=.531
3	Speed of processing (English)	.508	.023	F=.1.53 *P*=.223